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00 – Technical data

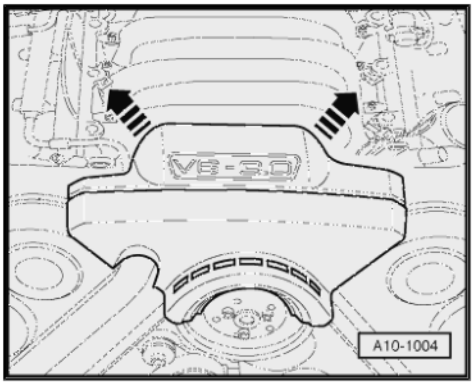
1 Technical data

1.1 Engine number

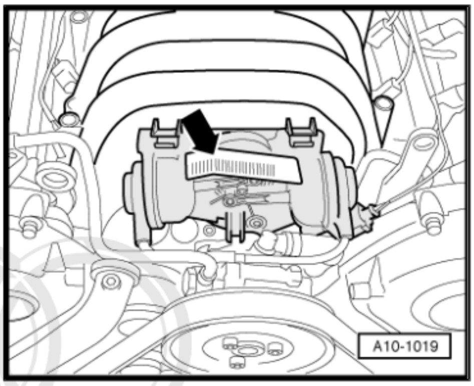
Note

A number of steps are required to make the engine number visible.

– Pull off front engine cover -arrows-.

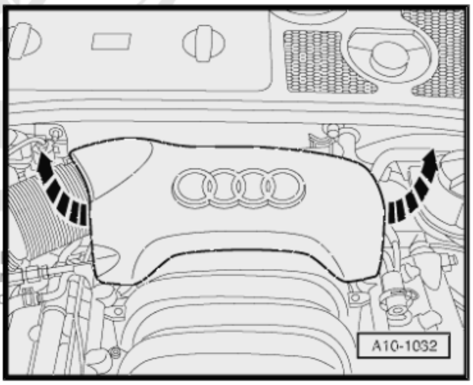


There is a sticker on the vacuum unit housing for intake manifold change-over function indicating the “Engine code” and “Serial number” -arrow-.



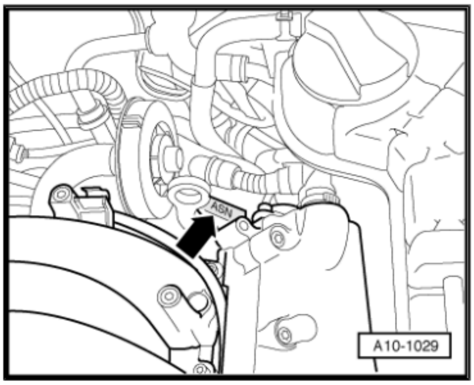
If the sticker is missing and you require the “Engine code”, proceed as follows:

– Pull off rear engine cover -arrows-.



The engine code is stamped on the rear of the cylinder head (left-side) -arrow-.

The engine code is also included on the vehicle data sticker.



1.2 Engine data

Code letters	ASN	BBJ
Capacity ltr.	2.976	2.976
Power output kW at rpm	162/6300	160/6300
Torque Nm at rpm	300/3200	300/3200
Bore ∅ in mm	82.5	82.5
Stroke mm	92.8	92.8
Compression	10.3	10.3
RON	98 1)	98 1)
Injection/ignition system	Bosch Motronic	Bosch Motronic
Exhaust gas recirculation	no	no
Turbocharging/supercharging	no	no
Knock control	yes	yes
Camshaft timing control	yes	yes
Intake manifold change-over	yes	yes
Secondary air system	yes	yes

---

1) Unleaded premium RON 95 can also be used, but results in reduced power

2 Safety precautions

2.1 Working on the fuel system

When working on the fuel system note the following warnings:

> WARNING
>
> *The fuel system operates at extremely high pressure. This can cause injury.*
>
> - *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*
> - *Wrap a clean cloth around the connection and carefully loosen the connection to allow the residual pressure to dissipate.*

– Procedure before opening high-pressure section of injection system ⇒ Rep. Gr. 24 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- Always switch off ignition before washing engine.
- Faults are stored in engine control units if electrical connectors were unplugged and engine was started: “Generate readiness code” in “Guided Functions” ⇒ Vehicle diagnostic tester .

> Caution
>
> *To prevent damage to the electronic components when disconnecting the battery:*
>
> - *Observe notes on procedure for disconnecting the battery.*
> - *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Rep. Gr. 27 .

2.2 Procedure before opening high-pressure section of injection system

> WARNING
>
> - *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).*
> - *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar prior to opening the system. Procedure ⇒ Rep. Gr. 24 .*

2.3 Working on the cooling system

When working on the cooling system note the following warnings:

WARNING

Hot steam/hot coolant can escape - risk of scalding.

- *The cooling system is under pressure when the engine is hot.*
- *To allow pressure to dissipate, cover filler cap on expansion tank with cloth and open carefully.*

Caution

Overheating can occur if the filler cap is not fitted properly.

- *The filler cap must engage positively and audibly when it is closed.*

2.4 Using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:

WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

2.5 Working on the exhaust system

When working on the exhaust system please note the following:

Caution

Avoid damage to flexible joint.

- *Do not bend flexible joint more than 10°.*
- *Install flexible joint so that it is not under tension.*
- *Take care not to damage wire mesh on flexible joint.*

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3 Contact corrosion!

- Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts. nuts, washers, etc.).
- For this reason, only fasteners with a special surface coating are used. These elements can be recognised by their greenish colour.
- In addition, all rubber parts, plastic parts and adhesives are made of non-conductive materials.
- Always fit new components when in doubt about the reuseability of old components.

WARNING

- *Only use genuine Audi parts.*
- *Accessories must be approved by AUDI AG.*
- *Damage caused by contact corrosion is not covered under warranty.*

4 General repair instructions

4.1 Rules for cleanliness when working on fuel supply system, injection system and turbocharger

Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set -VAS 6122- .
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open, do not work with compressed air and do not move the vehicle.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

4.2 Checking fuel system for leaks

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- Check complete fuel system for leaks.
- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section of fuel system again for leaks.

4.3 Foreign particles in engine

- When performing assembly work on engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set -VAS 6122-) to prevent foreign particles from entering the engine.
- In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion chambers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.

4.4 Contact corrosion!

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- We recommend the use of Audi accessories.
- Damage caused by contact corrosion is not covered under warranty.

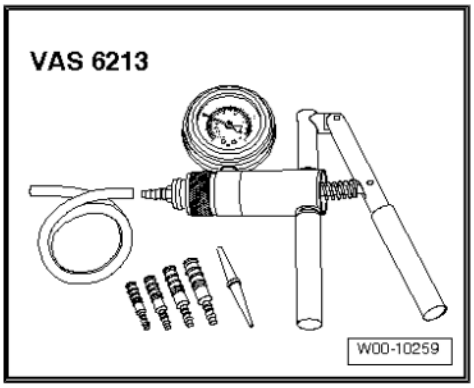
4.5 Routing and attachment of pipes, hoses and wiring

- Mark fuel lines, hydraulic lines, vacuum lines, lines for activated charcoal filter system and electrical wiring etc. before removal so they can be re-installed in the original positions and correctly connected. Make sketches or take photographs if necessary.
- To prevent damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (little space in engine compartment).

4.6 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Lines porous or leaking

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If a fault is stored in the fault memory, check the vacuum lines leading to the corresponding component and also check the remaining vacuum lines in the system.

– If it is not possible to build up a vacuum with the hand vacuum pump -VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

4.7 Installing radiators and condensers

Even when the radiator and condenser are correctly installed, slight impressions may be visible on the fins of these components. This does not mean that the components are damaged. If the fins are only very slightly distorted, this does not justify renewal of the radiator or the condenser.

10 – Removing and installing engine

1 Removing and installing engine

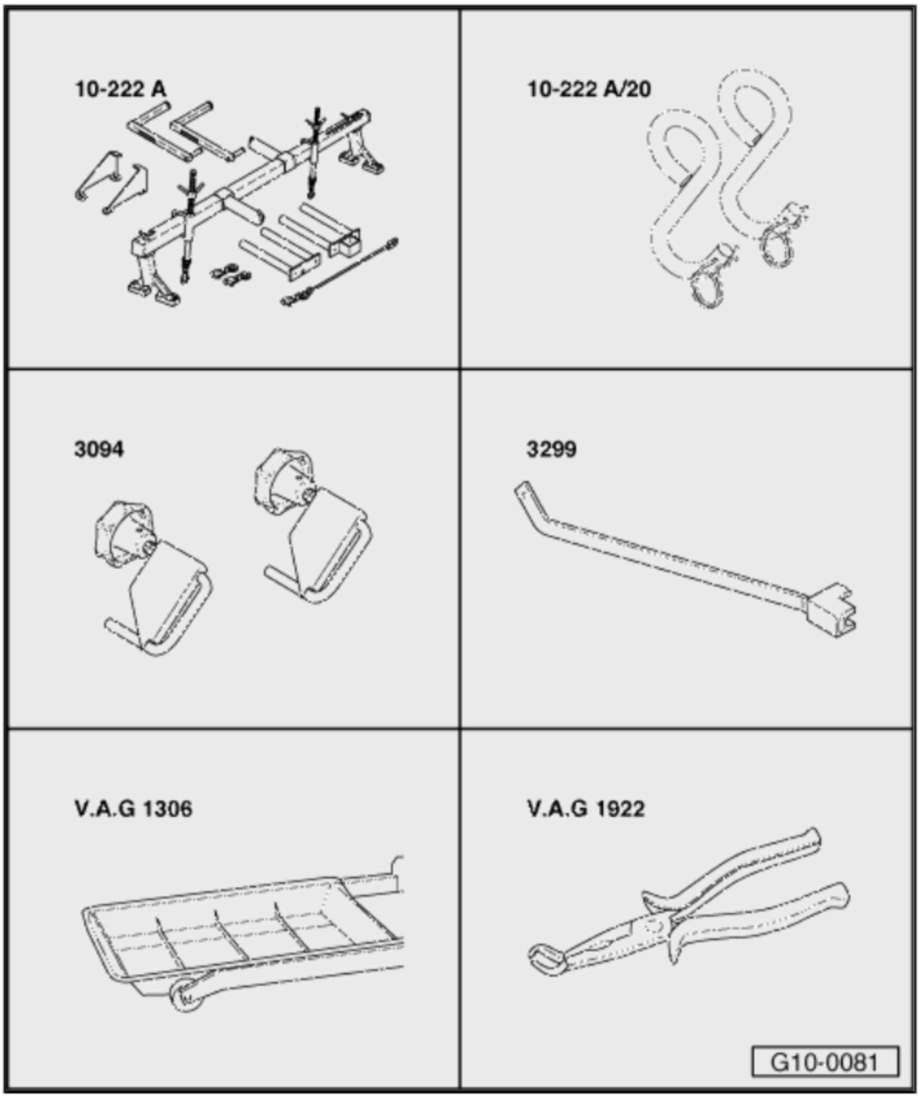
1.1 Removing and installing engine

Note

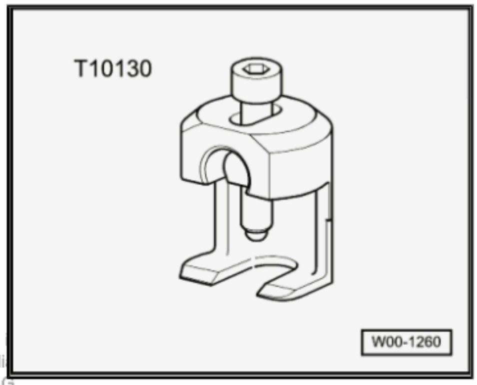
- *Renew all cable ties which are opened or cut open when removing the engine. Refit in the same position when installing the engine.*
- *The engine is removed upwards without gearbox.*
- *Collect drained coolant in a clean container for re-use or disposal.*

Special tools and workshop equipment required

- Support bracket -10-222 A-
- Adapter -10-222 A/20- (additional hooks)
- Hose clamps for hoses up to 25 mm Ø -3094-
- Poly V-belt lever -3299- with bracket -3299/1-
- Drip tray -V.A.G 1306-
- Spark plug connector pliers -V.A.G 1922-



- ◆ Puller -T10130-
- ◆ Drip tray



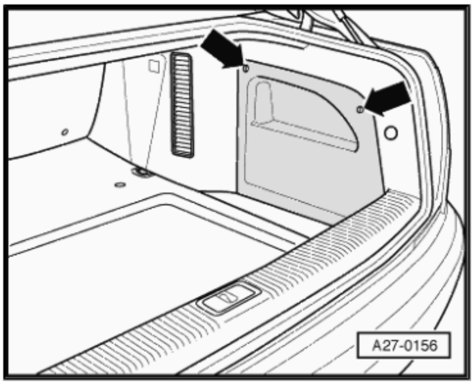
1.2 Removing

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

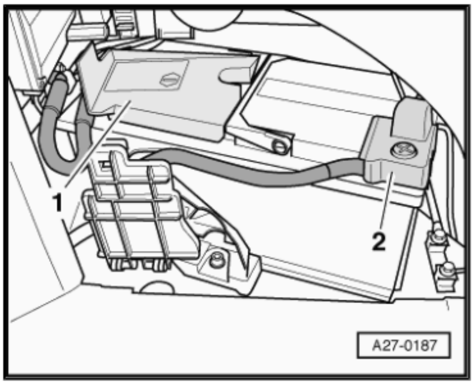
WARNING

Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. Gr. 27 .

- Switch off ignition.
- Remove luggage compartment side trim cover (right-side) -arrows-.



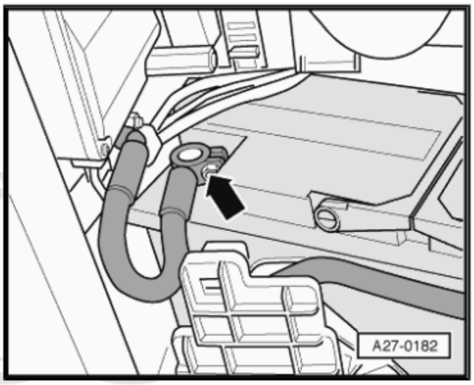
- Remove cover -1- over battery.



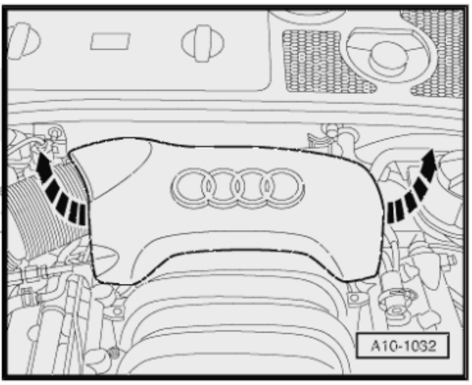
Note

Ignore item marked -2-.

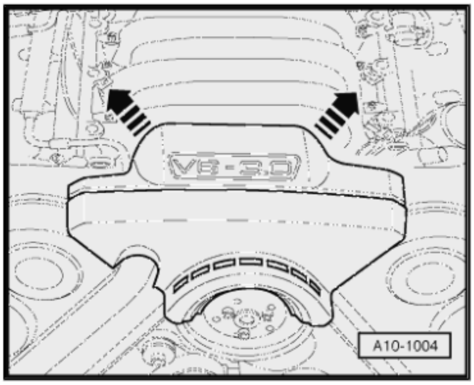
- Disconnect earth cable -arrow- at battery.



- Pull off rear engine cover -arrows- ...

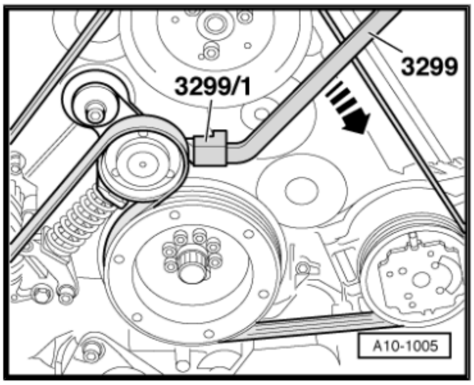


- ... as well as front engine cover -arrows-.



Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



– To slacken the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the arrow.

– Remove poly V-belt from pulley for vane pump.

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

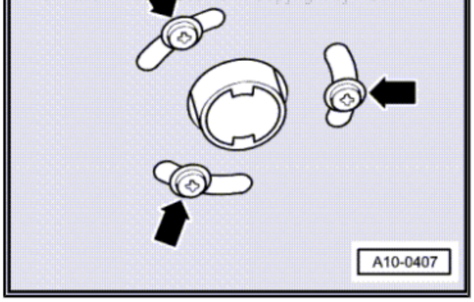
– Remove both front wheels.

Note

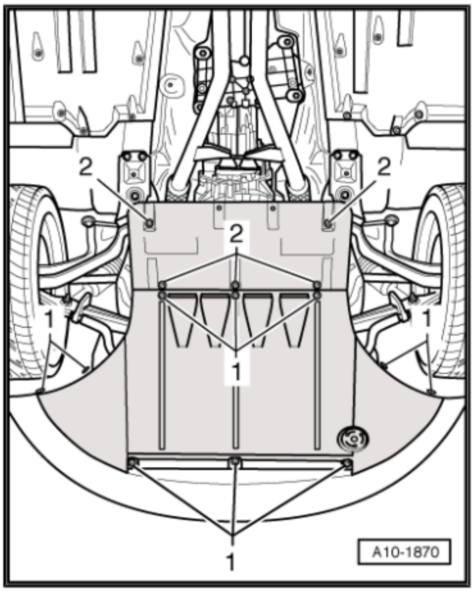
Secure brake discs with wheel bolts.

– Remove front and rear section of wheel housing liner (front right) ⇒ General body repairs, exterior; Rep. Gr. 66 .

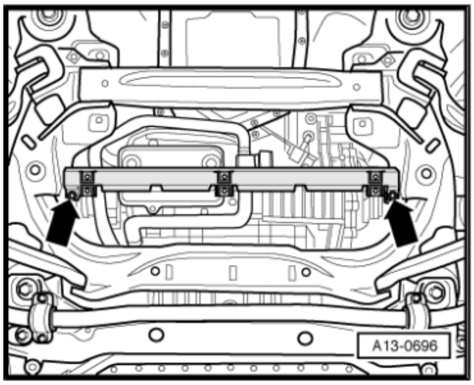
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



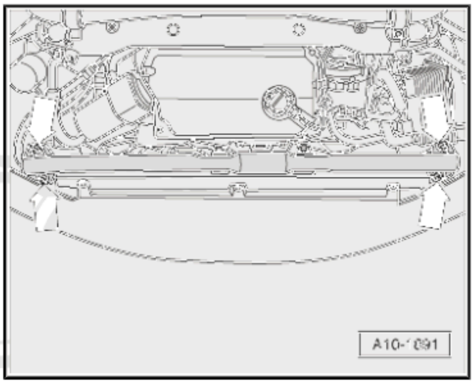
- Loosen quick release fasteners -1- and remove front noise insulation.



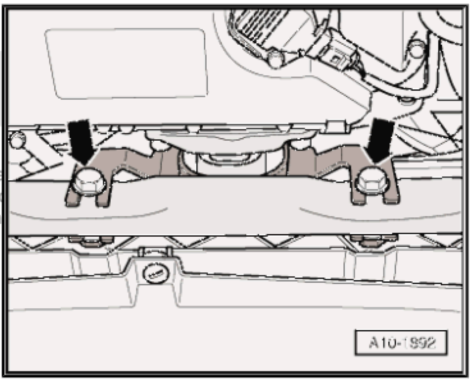
- Unbolt bracket for noise insulation -arrows-.



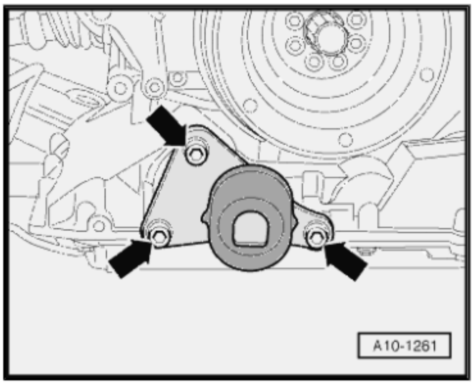
- Unbolt cross piece at lock carrier -arrows-.



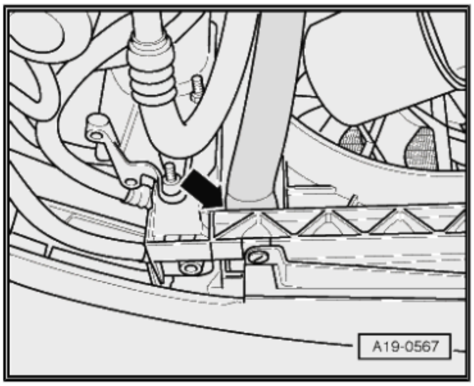
- Unbolt cross piece at stop for torque reaction support -arrows- and remove.



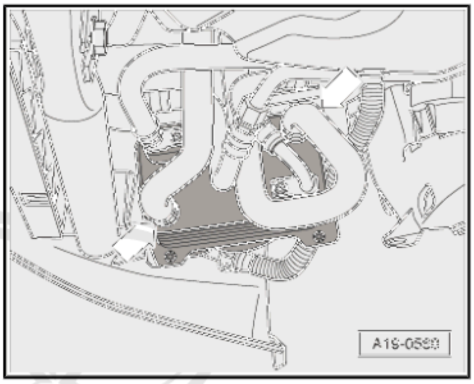
- Unscrew torque reaction support -arrows- and remove together with stop for torque reaction support.



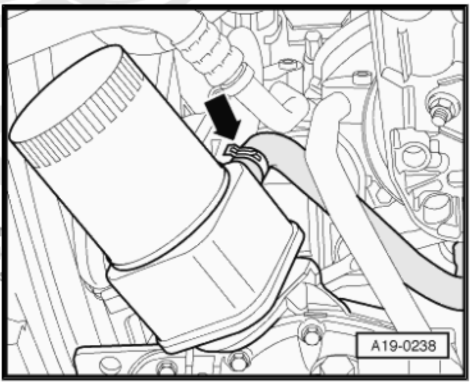
- Place drip tray -V.A.G 1306- under engine.
- Detach coolant hose from bottom left of radiator -arrow- and drain off coolant.



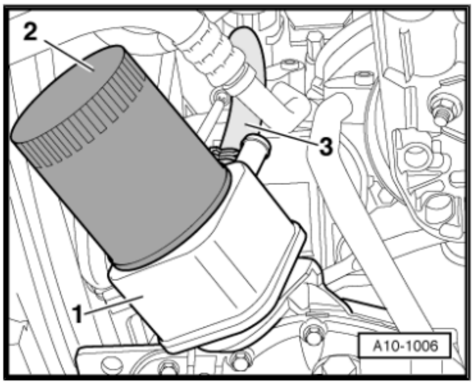
- Disconnect coolant hoses -arrows- from ATF cooler and drain off coolant.



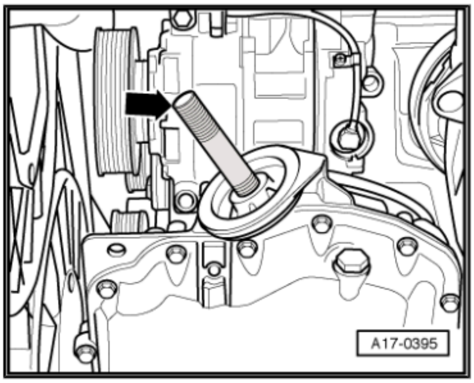
- Also disconnect coolant hose at oil cooler -arrow-, and drain off remaining coolant.



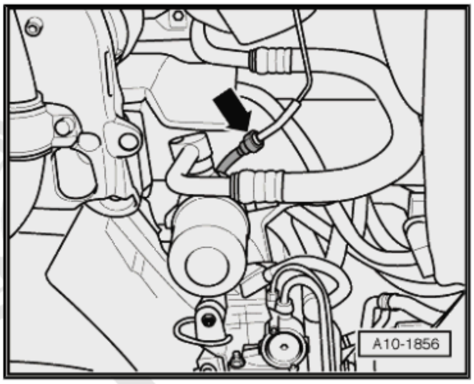
- Place drip tray below engine.
- Drain engine oil.
- Remove oil filter -2-.
- Place drip tray -V.A.G 1306- under engine.
- Remove coolant hose -3- at oil cooler.
- Remove oil cooler -1-.



- Unscrew oil pressure pipe -arrow- out of top section of sump.



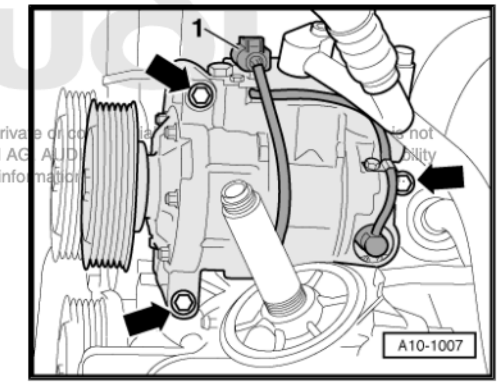
- Disconnect vacuum hose -arrow- going to vacuum reservoir.



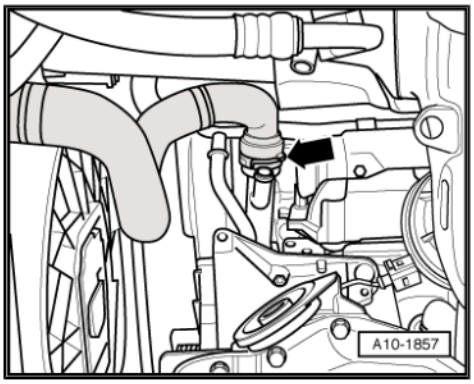
- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

> **WARNING**
>
> *Refrigerant circuit of air conditioner must not be opened.*

- Unscrew air conditioner compressor from bracket -arrows-.
- Tie up air conditioner compressor with lines attached to left-side of vehicle.



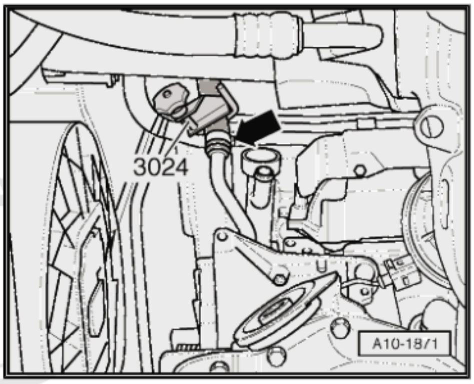
- Detach coolant hose from engine by releasing retaining clip -arrow-.



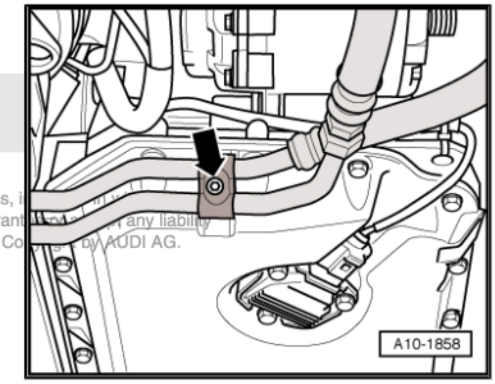
Note

Lay a cloth under the hydraulic hose to catch any escaping hydraulic fluid.

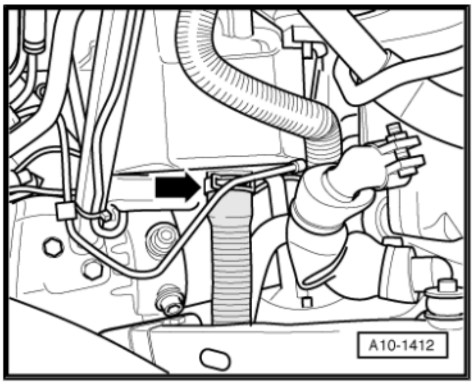
- Use hose clamp -3094- to clamp off hydraulic hose for vane pump.
- Detach hydraulic hose at the connection indicated -arrow-.



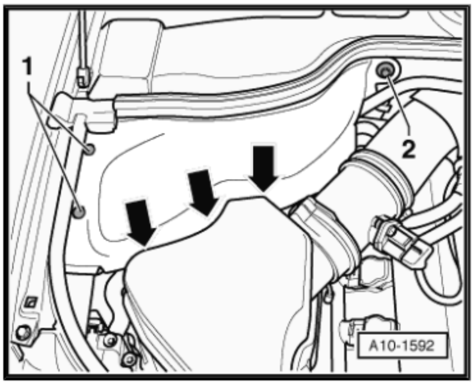
- Unscrew bracket for ATF line (right-side) at bottom section of sump -arrow-.



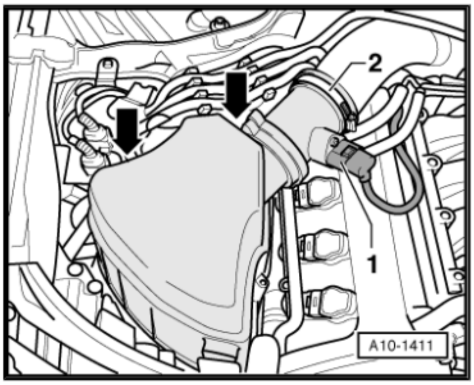
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



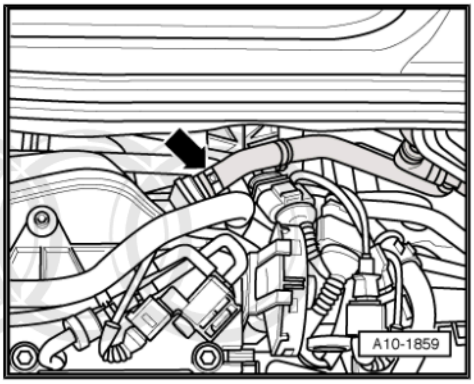
- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



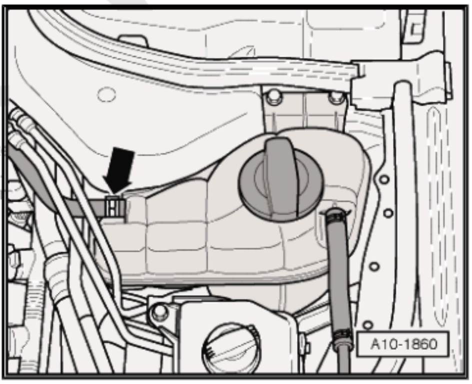
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



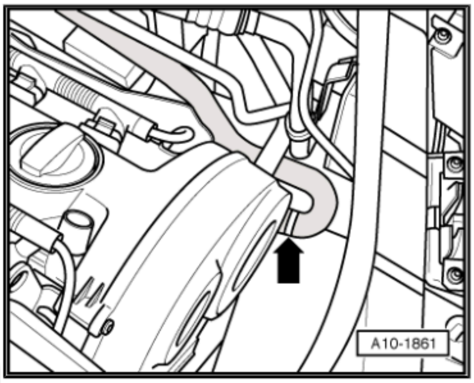
- Detach vacuum hose -arrow- going to brake servo at non-return valve.



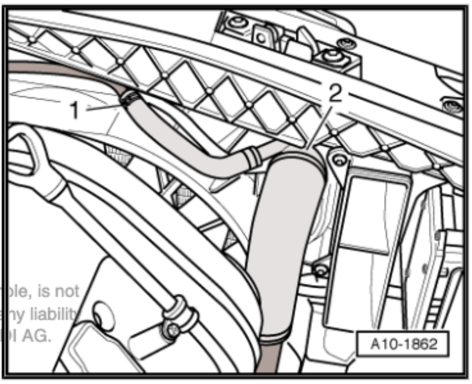
- Detach coolant hose -arrow- at expansion tank.



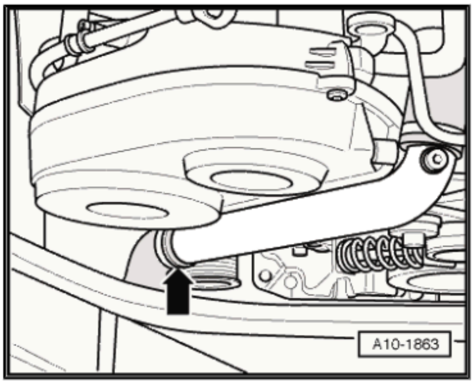
- Detach coolant hose (front left) -arrow- at engine.



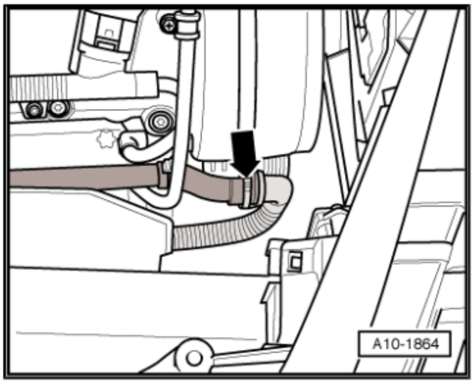
- Detach coolant hoses -1- and -2-.



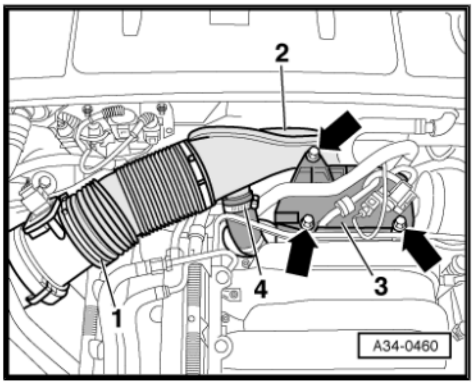
- Detach coolant hose (front right) at engine -arrow-.
- Remove coolant hoses.



- Disconnect hose -arrow- at pipe for secondary air.



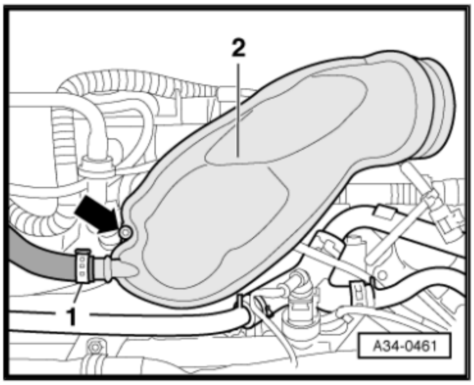
- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Detach hose -4- for crankcase breather system at air duct -2-.



Note

Ignore item marked -1-.

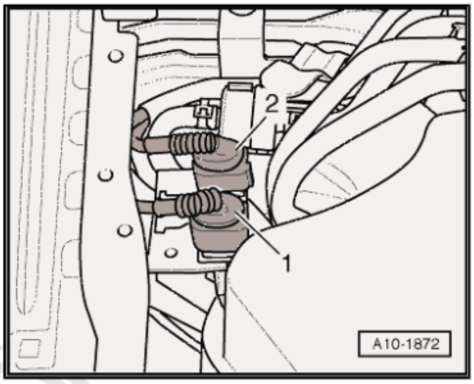
- Unscrew bolt -arrow- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.



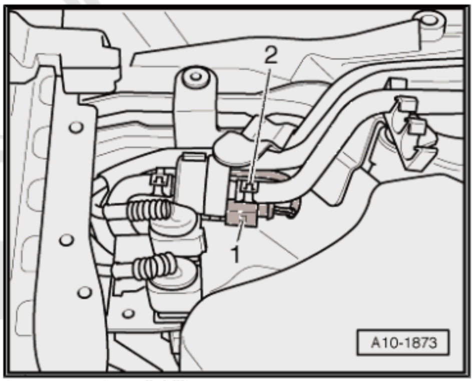
Note

For illustration purposes, the air duct is shown from rear and with engine removed.

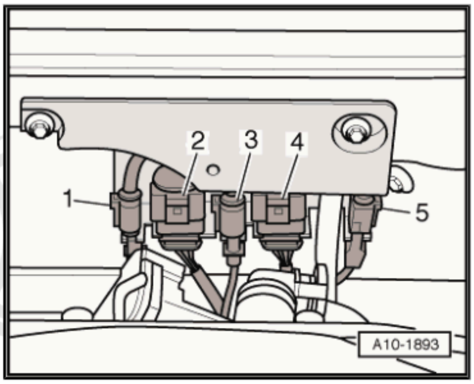
- Detach electrical connectors -1- and -2- for Lambda probe after catalytic converter -G130- and Lambda probe II after catalytic converter -G131- from bracket and disconnect.



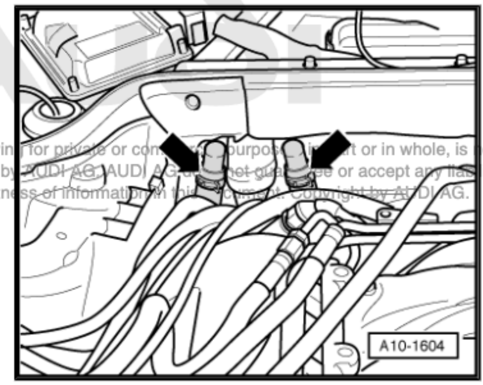
- Disconnect electrical connector -1- at solenoid valve 1 for activated charcoal filter system -N80- .
- Move wiring harness clear.
- Disconnect hose -2- at solenoid valve 1 for activated charcoal filter system -N80- and move clear.



- Unscrew bracket for connectors (rear centre) from bulkhead.
- Remove all electrical connectors from the bracket.
- Disconnect electrical connectors -2-, -3- and -4- and move connectors clear.



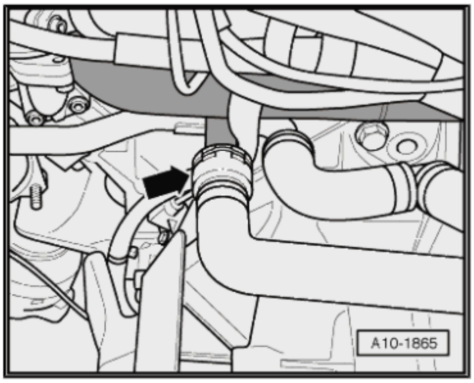
- Detach coolant hoses going to to heat exchanger at bulkhead -arrows-.



- Detach coolant hose (rear left) -arrow- at engine.
- Remove coolant hose.

Note

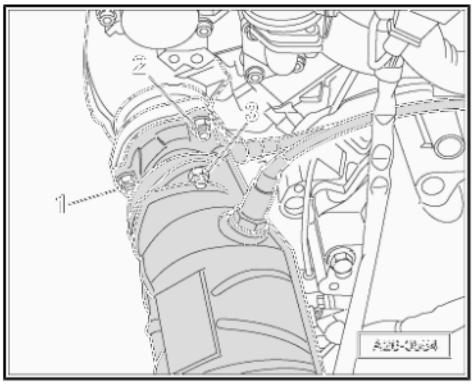
Shown from rear with engine removed for illustration purposes.



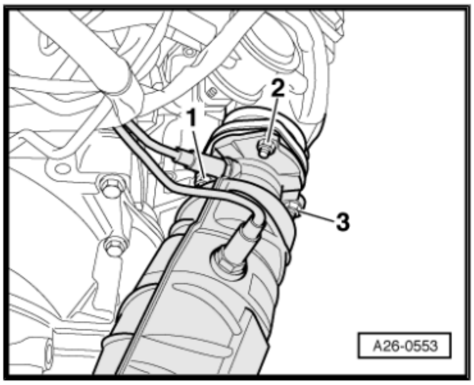
- Unscrew nut -2- (accessible from above) securing front exhaust pipe to exhaust manifold (left-side).

Note

Shown from rear with engine removed for illustration purposes.

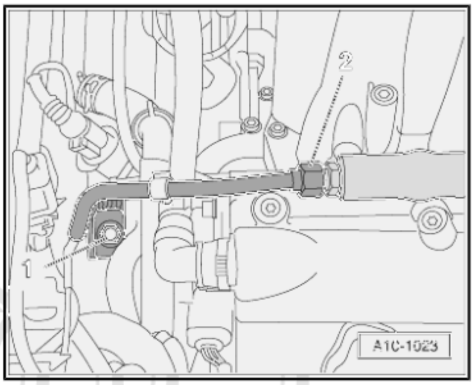


- Unscrew nut -2- (accessible from above) securing front exhaust pipe to exhaust manifold (right-side).



Note

Shown from rear with engine removed for illustration purposes.



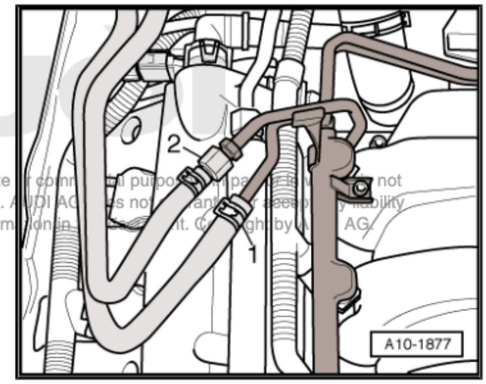
Note

Lay a cloth under the hydraulic pressure pipe to catch any escaping hydraulic fluid.

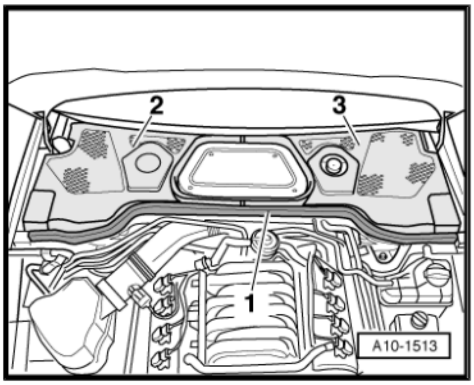
- Unbolt hydraulic pressure line for power-assisted steering at rear coolant pipe -1- and disconnect line near cylinder head (right-side) -2-.

WARNING

Rules for cleanliness when working on the injection system ⇒ page 6 .

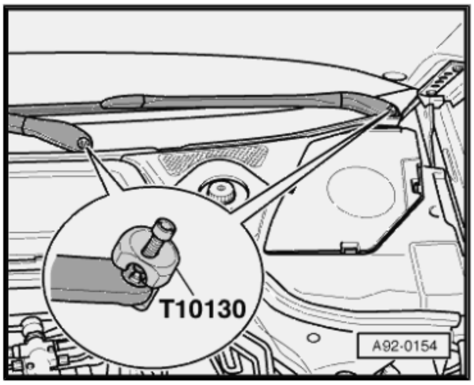


- Disconnect fuel return pipe -1- and fuel supply pipe -2- at fuel rail.



- Pull off rubber seal -1- on plenum chamber covers.
- Remove plenum chamber covers -2- and -3-.

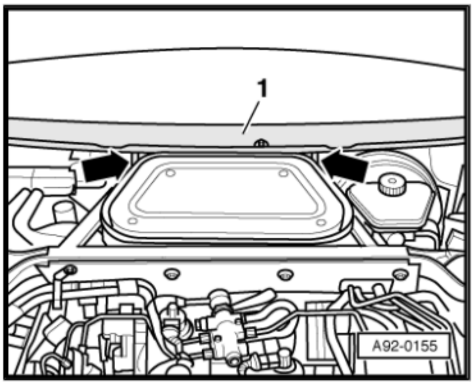
- Use screwdriver to pry off cover caps on wiper arms and unscrew hexagon nuts.
- Pull wiper arms off wiper shafts with puller -T10130- and remove.



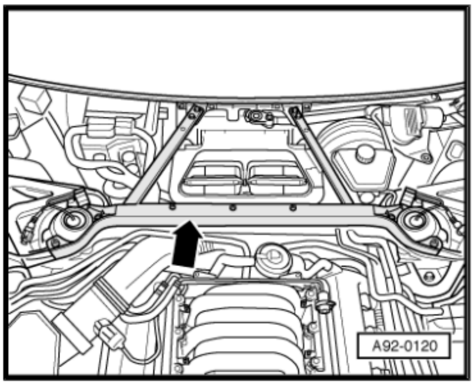
- Remove the dust/pollen filter; to do so, open the 4 quick release fasteners.

Note

Cover air duct at air conditioner housing with clean cloth to prevent anything falling in.



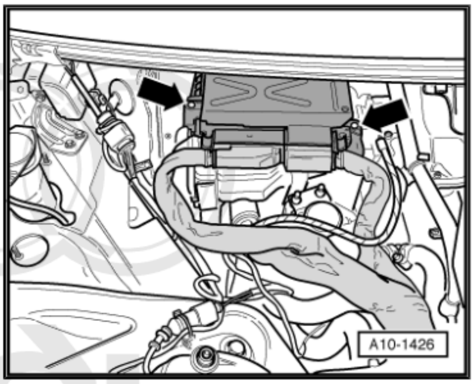
- Unscrew bolts on left and right -arrows- for cowl panel grille -1-.
- Carefully pull cowl panel grille off retainer at windscreen.
- Unscrew dome brace -arrow-.



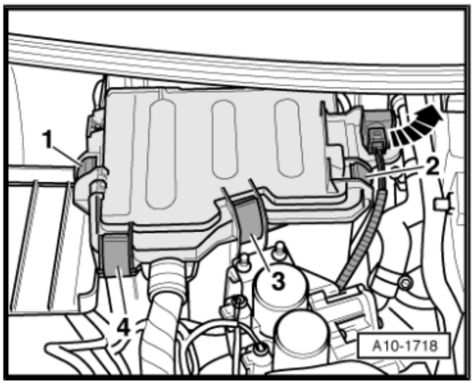
- Unscrew bolts -arrows-.
- Detach retainers and engine control unit from electronics box (plenum chamber).

Note

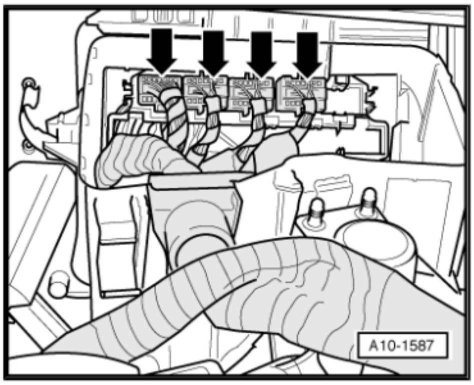
The wires remain connected.



- Turn air quality sensor -G238- approx. 90° anti-clockwise -arrow- and remove from retainer.
- Release the retaining clips -1 … 4-.
- Open electronics box (plenum chamber) cover slightly and pull off to front.



- Disconnect the electrical multi-pin connectors -arrows- using spark plug connector pliers -V.A.G 1922- .
- Detach the engine wiring harness at electronics box and at bulkhead.
- Place engine control unit with wiring harness attached on top of engine.

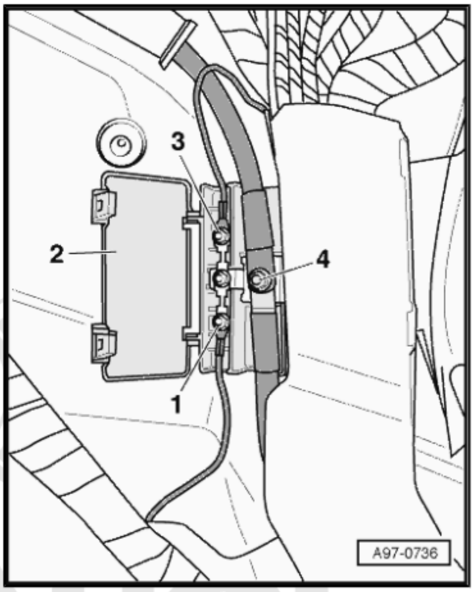


Note

Secure the engine control unit to prevent it falling.

- Remove trim (left-side) for A pillar ⇒ General body repairs, interior; Rep. Gr. 70 .
- Fold back floor carpet.

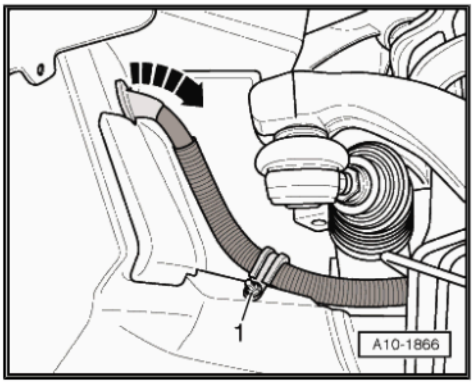
- Fold cover -2- to side.
- Unscrew nut -4-.
- Detach terminal 30 wire to starter.



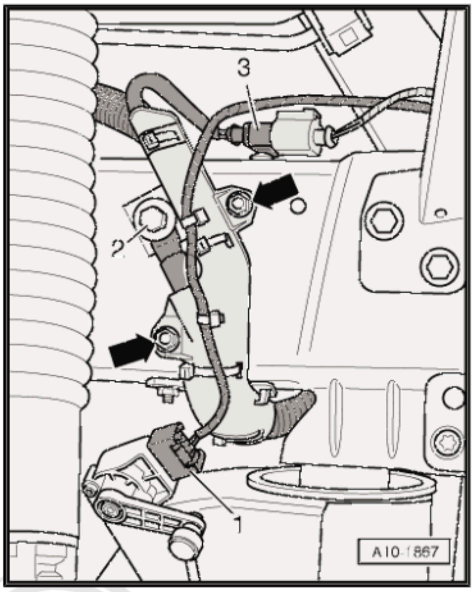
Note

Ignore items marked -1- and -3-.

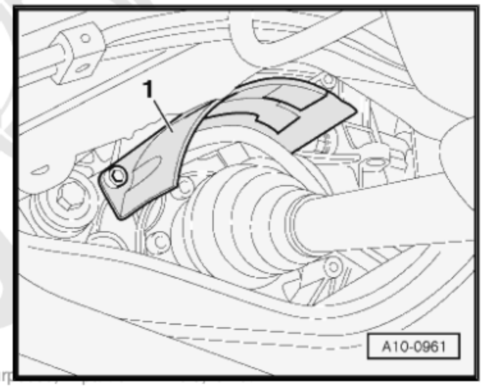
- Unscrew wiring clamp -1- in wheel housing (front right).
- Pull wiring harness out from interior -arrow-.



- Unplug electrical connectors -1- and -3-.
- Unbolt earth cable -2- at longitudinal member.
- Unscrew bracket for wiring harness at longitudinal member -arrows- and move wiring harness clear.



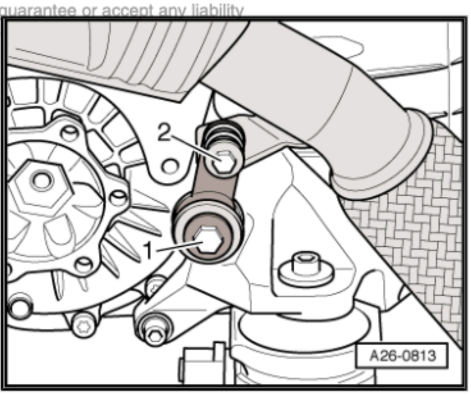
- Unscrew heat shields for drive shafts (left and right-side) from gearbox -1-.



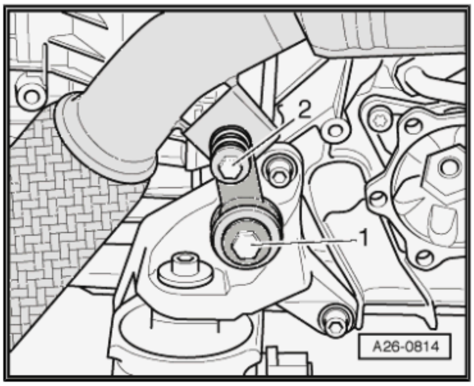
- Remove bolt -1- on bracket (left-side) for exhaust system.

Note

Ignore item marked -2-.



- Remove bolt -1- on bracket (right-side) for exhaust system.



Note

Ignore item marked -2-.

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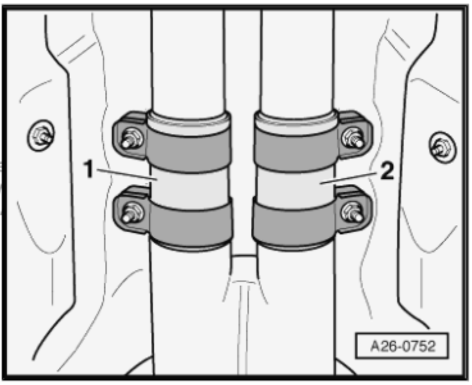
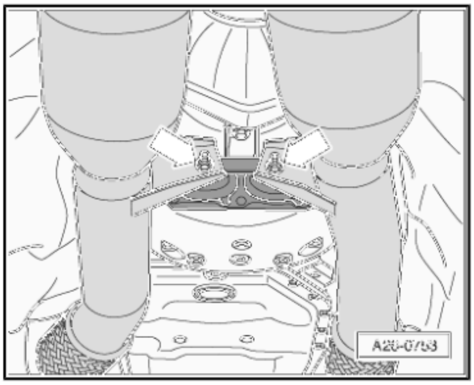
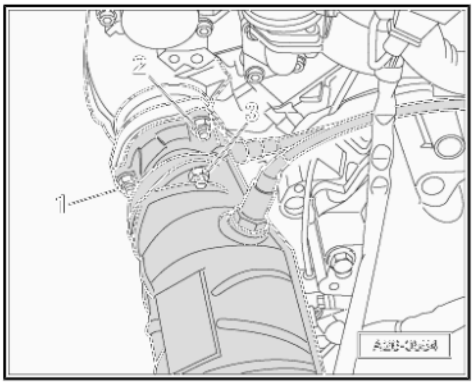
- Loosen clamps -1- and -2-.



- Unscrew nuts -arrows- on brackets for front exhaust pipes (left and right-side).



- Remove nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold (left-side).



Note

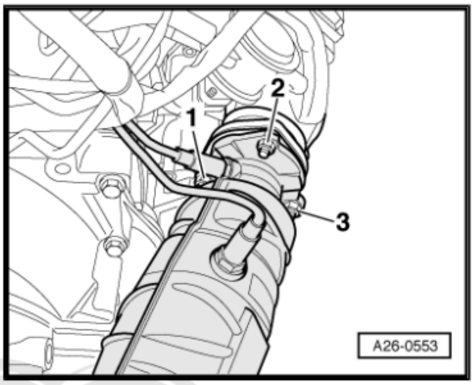
Shown in illustration with engine removed.

- Detach front exhaust pipe from exhaust manifold (left-side).

Note

The front exhaust pipe remains in vehicle.

- Remove nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold (right-side).

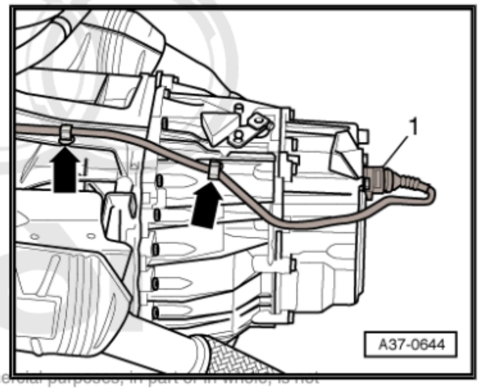


Note

Shown in illustration with engine removed.

- Detach front exhaust pipe from exhaust manifold (right-side).

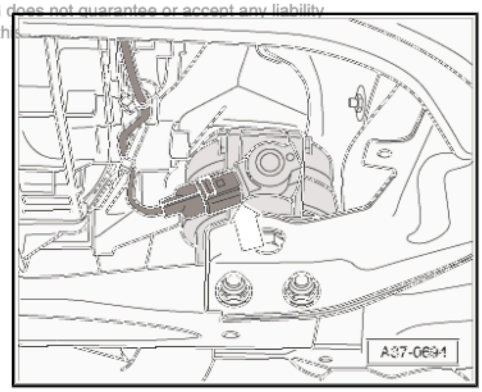
- Release electrical connector -1- and detach from gearbox.
- Move wiring harness going to engine clear -arrows-.



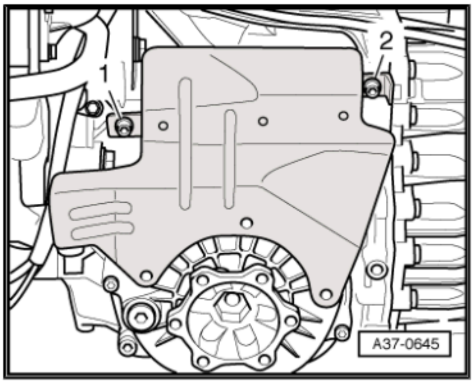
Note

Shown in illustration with gearbox removed.

- Disconnect electrical connectors -arrow- on gearbox mountings (left and right-side) and move wires clear.



- Remove bolt -1- for heat shield (left-side) on gearbox.

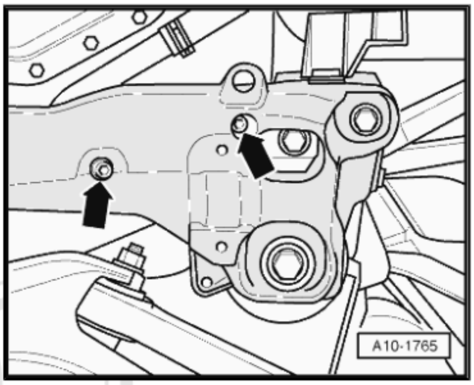


Note

Ignore item marked -2-.

- Unscrew the securing bolts for engine/gearbox assembly that are accessible from below.

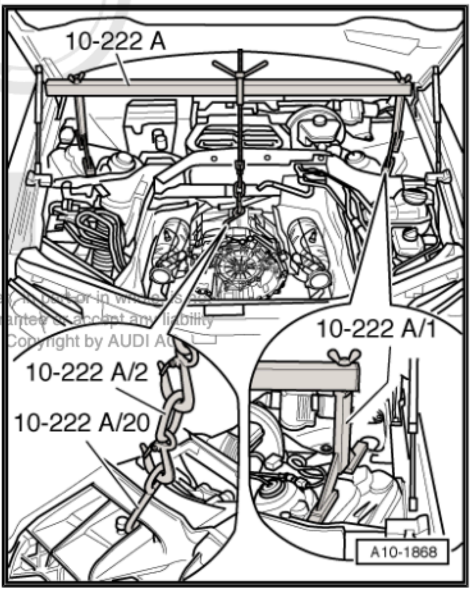
- Remove bolts -arrows- for engine mounting (left and right-side)



- Unscrew the securing bolts for engine/gearbox assembly that are accessible from above.
- Place the feet -10-222 A/1- of support bracket -10-222 A- on the suspension turrets as shown in the illustration.
- • The spindle is located at front.
- Hang the adapter -10-222 A/20- (hooks) in the gearbox stiffener ridge next to the breather as shown in the illustration.
- Hang the spindle of support bracket -10-222 A- with extension -10-222 A/2- onto adapter -10-222 A/20- (hook).
- Take up weight of engine slightly with spindle.

Note

Shown in illustration with engine removed.



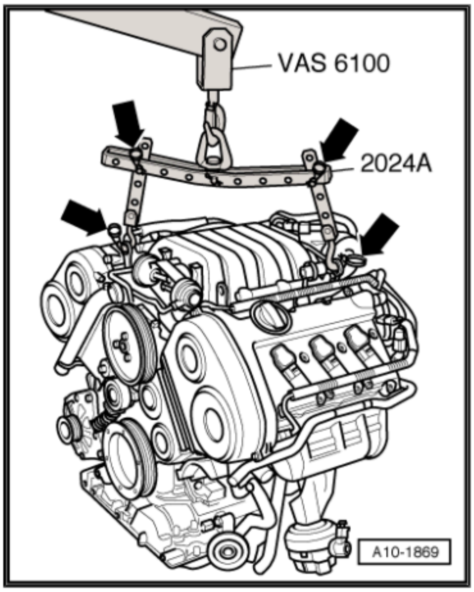
- Attach the lifting tackle -2024 A- to engine and workshop crane -VAS 6100- as shown in the illustration.

Note

- ♦ *To adjust to the centre of gravity for the assembly, the perforated rails of support hooks must be positioned as shown.*
- ♦ *Shown in illustration with engine removed.*

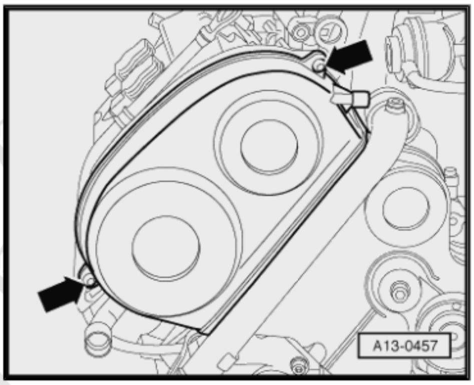
WARNING

The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.



- Pull off bonnet seal at lock carrier.

- Unscrew toothed belt guard (front right) from cylinder head cover -arrows-.



Note

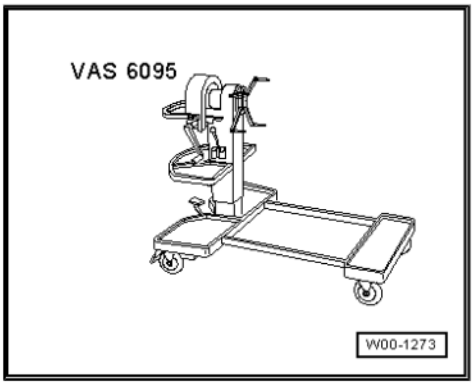
Check that all hoses and wiring connections between engine, gearbox and body have been detached.

- Raise engine with workshop crane -VAS 6100- until the engine mountings are clear.
- Tighten spindel of support bracket -10-222 A- further.
- Detach engine from gearbox and lift engine upwards out of engine compartment.

1.3 Securing engine to engine stand

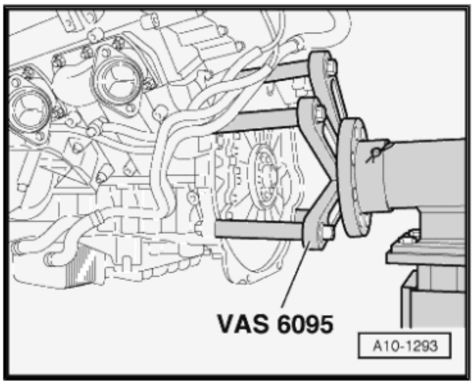
Special tools and workshop equipment required

- Engine stand -VAS 6095-



Procedure

- Secure the engine to engine stand -VAS 6095- as shown in the illustration.



1.4 Installing

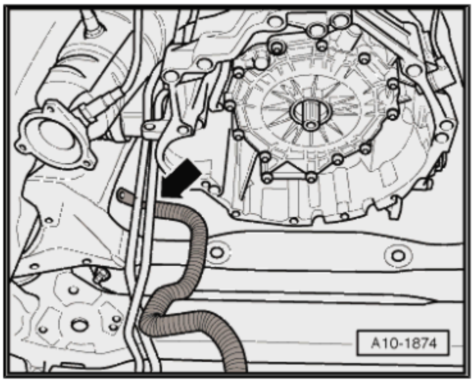
Installation is carried out in the reverse order; note the following:

Note

- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *Renew bolts for securing engine/gearbox.*
- *Heat insulation sleeves removed when taking out the engine are to be reinstalled in the original position.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Fit all cable ties in the original position when installing.*
- *Clean input shaft splines and splines of damper unit on flywheel; remove corrosion and apply only a very thin coating of grease -G 000 100- to the splines. Remove any excess grease.*

– Check whether dowel sleeves for centring the engine/gearbox assembly are fitted in the cylinder block; install dowel sleeves if necessary.

– Before inserting the engine into the engine compartment, lay the wiring harness for main fuse carrier between ATF lines and subframe as shown in the illustration.



– Guide engine carefully into body.

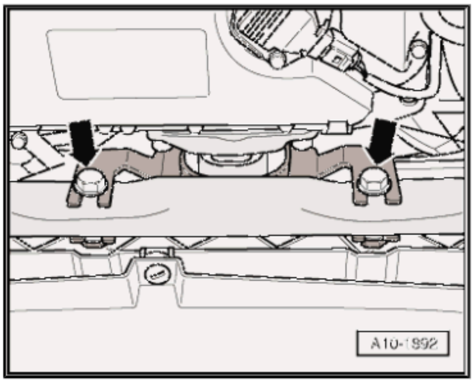
– Place engine down onto engine mountings.

– Bolt gearbox to engine ⇒ page 31 .

– Install exhaust system and align free of stress ⇒ page 215 .

– Install air conditioner compressor ⇒ Air conditioning system; Rep. Gr. 87 .

– Secure ATF lines ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 37 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 37 .



- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support and tighten bolts -arrows- to 65 Nm.
- Install poly V-belt ⇒ page 33 .
- Install body brace ⇒ Brake system; Rep. Gr. 47 .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. Gr. 27 .

> **WARNING**
>
> *Never use battery charging equipment for boost starting. There is danger of damaging the vehicle control units.*

- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Install and adjust wiper arms ⇒ Electrical system; Rep. Gr. 92 .
- Fill up with engine oil and check oil level ⇒ page 161 .
- Fill cooling system ⇒ page 165 .

Note

- *Drained-off coolant may only be used again if the original cylinder head or cylinder block are re-installed.*
- *Contaminated or dirty coolant must not be used again.*

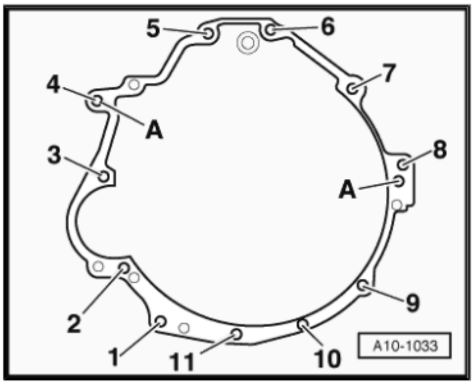
- Top up power steering fluid and bleed steering system: ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48

1.5 Tightening torques

Note

- *Tightening torques only apply to lightly greased, oiled, phosphated or blackened nuts and bolts.*
- *Additional lubricant such as engine oil or gearbox oil may be used, but do not use lubricant containing graphite.*
- *Do not use degreased parts.*
- *Tolerance for tightening torques ± 15%.*

Engine/gearbox attachment



Item	Bolt 2)	Nm
1, 10, 11	M10×45	45
2 3)	M10×80	65
3	M12×100	65
4, 8	M12×67	65
5, 6	M12×75	65
7	M10×90	45
9	M10×57	45

2) Renew bolts for securing engine/gearbox.

3) Bolt strength 10.9

A - Dowel sleeves for centring

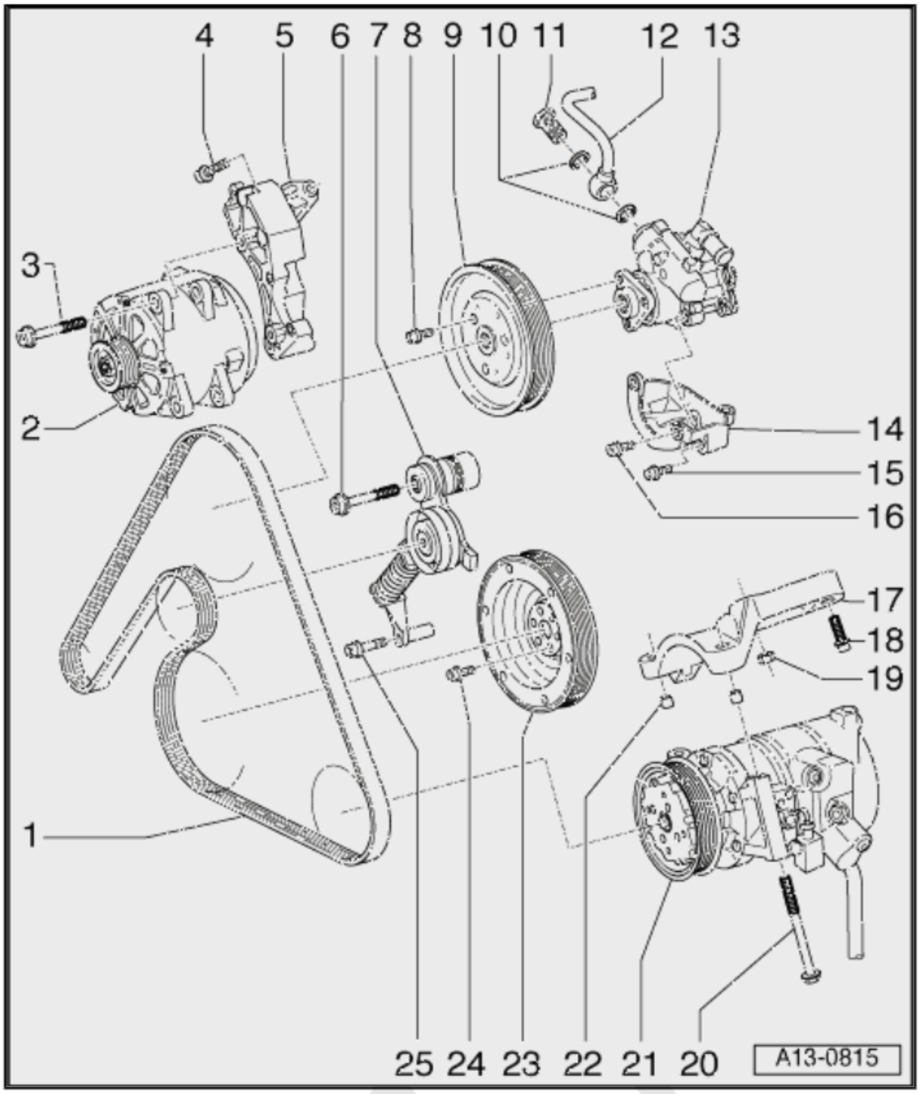
Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Toothed belt guard to cylinder head cover		6 4)
Engine mounting to engine support		23
Bracket for wiring harness to longitudinal member		10
Battery cable to fuse box		20
Fuel supply line to fuel rail		23
Pressure line for	Pressure hose	40
power-assisted steering to	Coolant pipe	20
Air duct to intake manifold		10
Oil cooler to sump (top section)		30
Oil filter to oil cooler		20
Torque reaction support to top section of sump		40
Cross piece to lock carrier		42
Stop for torque reaction support to cross piece		65

4) Renew (self-locking)

13 – Crankshaft group

1 Dismantling and assembling engine

1.1 Poly V-belt drive - exploded view



1 - Poly V-belt
  - ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
  - ☐ Removing and installing ⇒ page 33
  - ☐ Check for wear

2 - Alternator
  - ☐ Removing and installing ⇒ Electrical system; Rep. Gr. 27

3 - 23 Nm

4 - 23 Nm

5 - Bracket for alternator

6 - 40 Nm

7 - Tensioner for poly V-belt
  - ☐ Removing and installing ⇒ page 35

8 - 23 Nm

9 - Pulley for vane pump
  - ☐ To remove and install: counterhold with 2-hole pin wrench -3212-
  - ☐ Marked “Vorne/Front”

10 - O-rings
  - ☐ Renew

11 - Banjo bolt -47 Nm-

12 - Pressure line
  - ☐ To power-assisted steering

13 - Vane pump for power-assisted steering
  - ☐ Removing and installing ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48

14 - Bracket for vane pump

15 - 23 Nm

16 - 23 Nm

17 - Bracket for air conditioner compressor

18 - 23 Nm

19 - 23 Nm

20 - 25 Nm

21 - Air conditioner compressor

- ❑ Do not unscrew or disconnect refrigerant hoses or pipes.
- ❑ After detaching compressor from mountings, secure it to body with wire or similar. Do not leave it suspended from refrigerant pipes.

22 - Bush for air conditioner compressor

- ❑ 2 x

23 - Vibration damper

- ❑ Depending on version, thrust washer is fitted between vibration damper and toothed belt sprocket ⇒ page 36
- ❑ Removing and installing ⇒ page 36

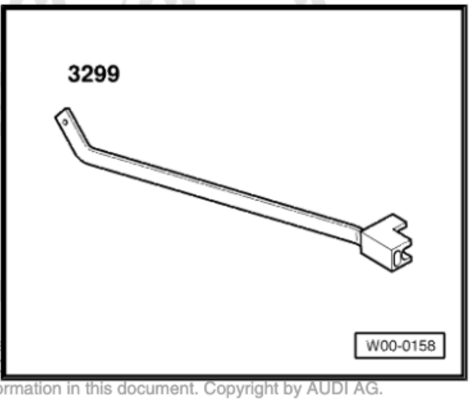
24 - 23 Nm

25 - 23 Nm

1.2 Removing and installing poly V-belt

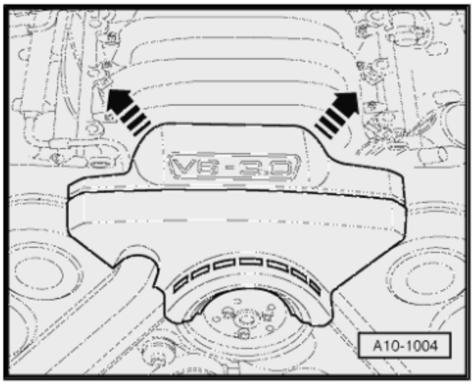
Special tools and workshop equipment required

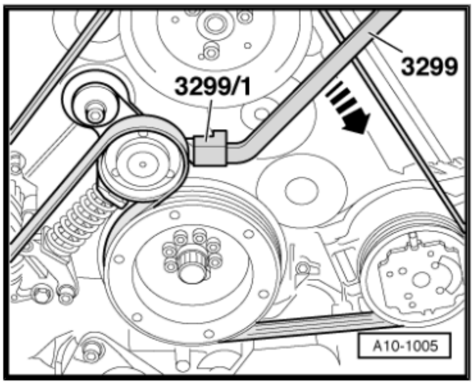
- ♦ Poly V-belt lever -3299- with bracket -3299/1-



Removing

– Pull off front engine cover -arrows-.





Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

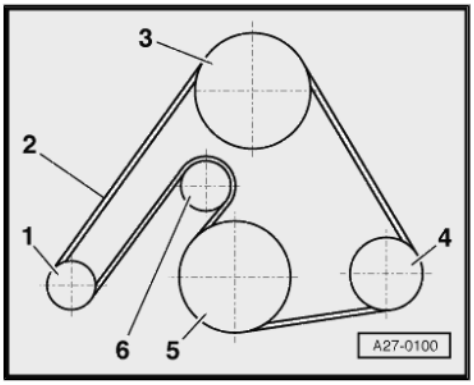
– To slacken the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-.

– Remove poly V-belt from pulley for vane pump.

Installing

Installation is carried out in the reverse order; note the following:

– First place poly V-belt over crankshaft pulley. Then push belt onto tensioning roller.



Routing of belt

1 -	Alternator
2 -	Poly V-belt
3 -	Vane pump for power-assisted steering
4 -	Air conditioner compressor
5 -	Crankshaft
6 -	Tensioning roller

Note

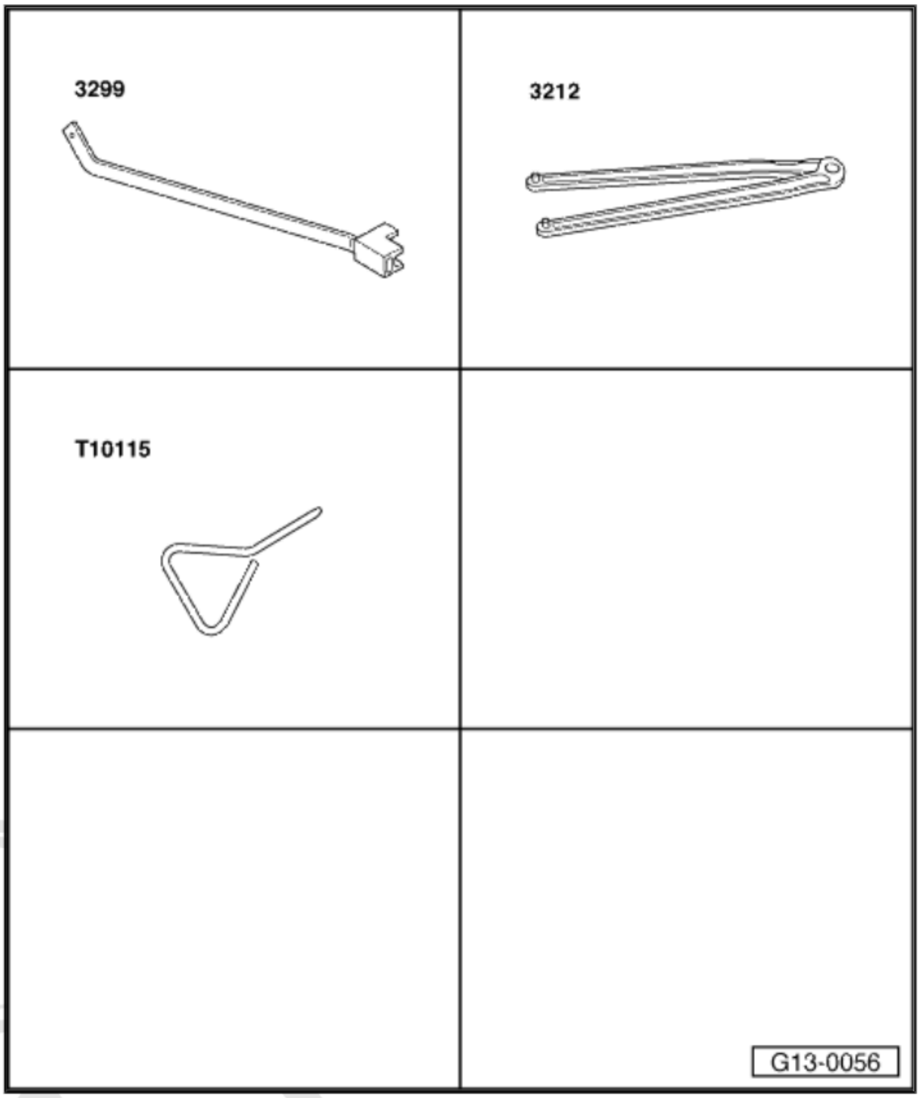
When installing poly V-belt, make sure it is properly seated on pulleys.

– Start engine and check that belt runs properly.

1.3 Removing and installing tensioner for poly V-belt

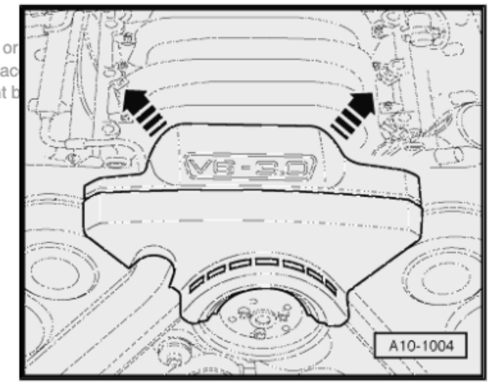
Special tools and workshop equipment required

- Poly V-belt lever -3299- with bracket -3299/1-
- 2-hole pin wrench -3212-
- Locking pin -T10115-



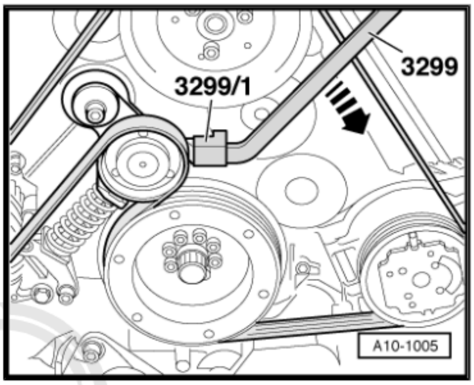
Removing

– Pull off front engine cover -arrows-.

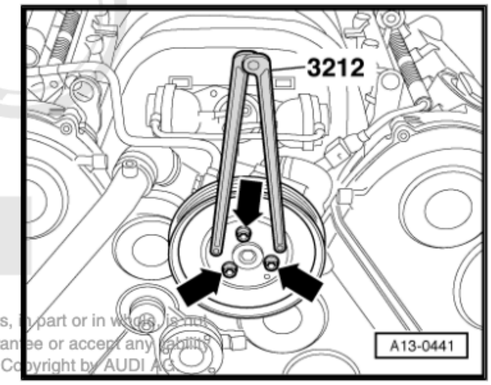


Note

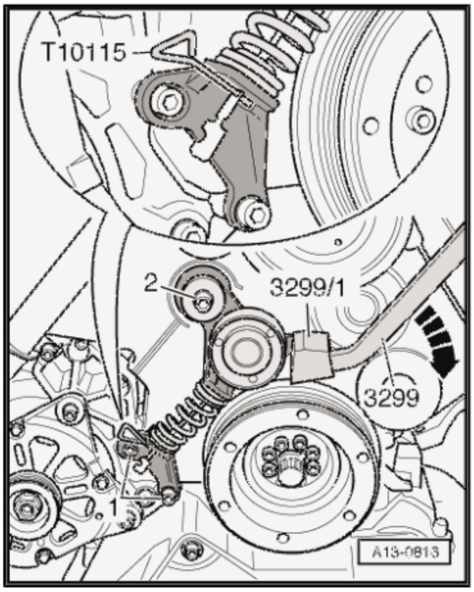
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



- To slacken the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-.
- Remove poly V-belt from pulley for vane pump.
- Unbolt poly V-belt pulley at vane pump -arrows-, using 2-hole pin wrench -3212- as a counterhold.



- To lock the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-, lock tensioner into place using locking pin -T10115- and release pressure.
- Unscrew bolts -1- and -2- and remove tensioner for poly V-belt (tensioner remains locked).



Installing

Installation is carried out in the reverse order; note the following:

- Install poly V-belt ⇒ page 33 .

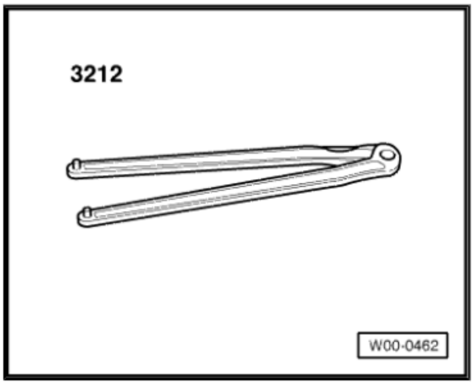
Tightening torque

Component	Nm
Tensioner for poly V-belt to bracket for alternator	23
Tensioner for poly V-belt to cylinder block	40

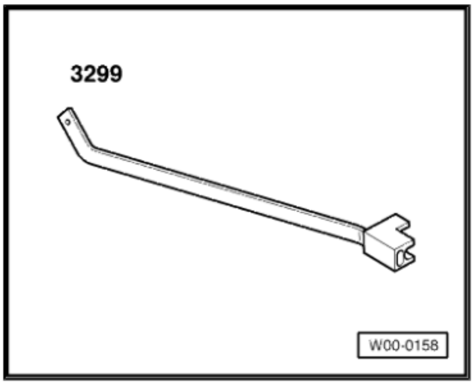
1.4 Removing and installing vibration damper

Special tools and workshop equipment required

- 2-hole pin wrench -3212-

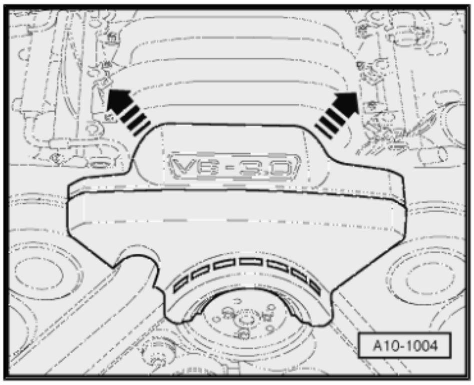


- Poly V-belt lever -3299- with bracket -3299/1-



Removing

– Pull off front engine cover -arrows-.

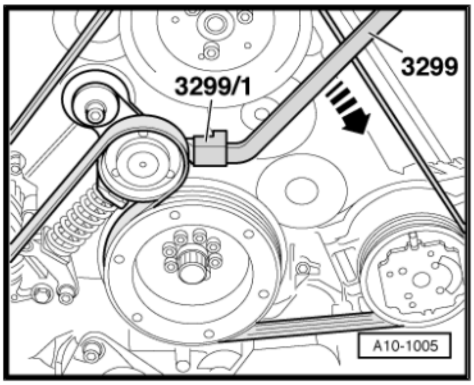


Note

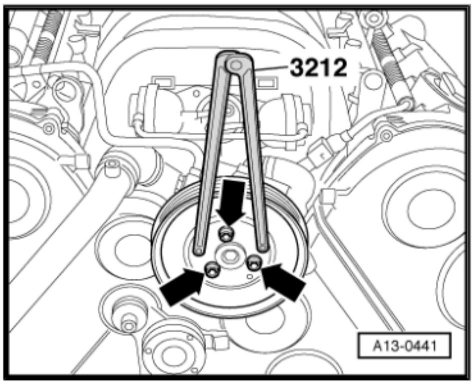
Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

– To slacken the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-.

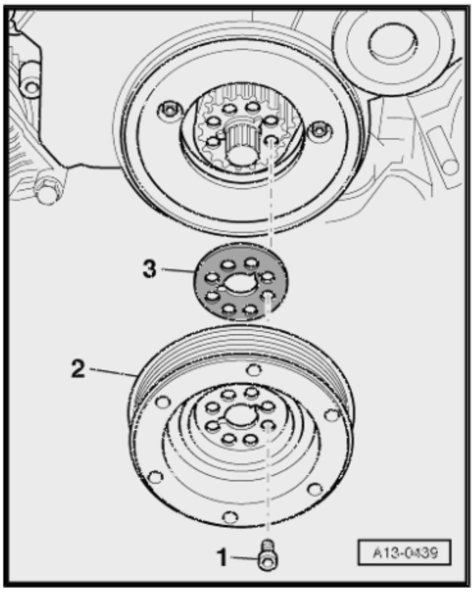
– Remove poly V-belt from pulley for vane pump.



- Unbolt poly V-belt pulley at vane pump -arrows-, using 2-hole pin wrench -3212- as a counterhold.



- Unscrew the 8 bolts -1-.
- Remove vibration damper -2- and thrust washer -3-.



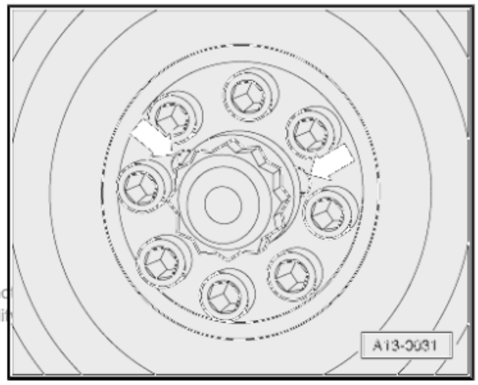
Note

The thrust washer -3- is only fitted in conjunction with toothed belt sprocket -06C 105 063 A- . If toothed belt sprocket -06C 105 063 B- is fitted, do NOT install thrust washer.

Installing

Installation is carried out in the reverse order; note the following:

- Install the thrust washer so that the curved rim faces towards the vibration damper.



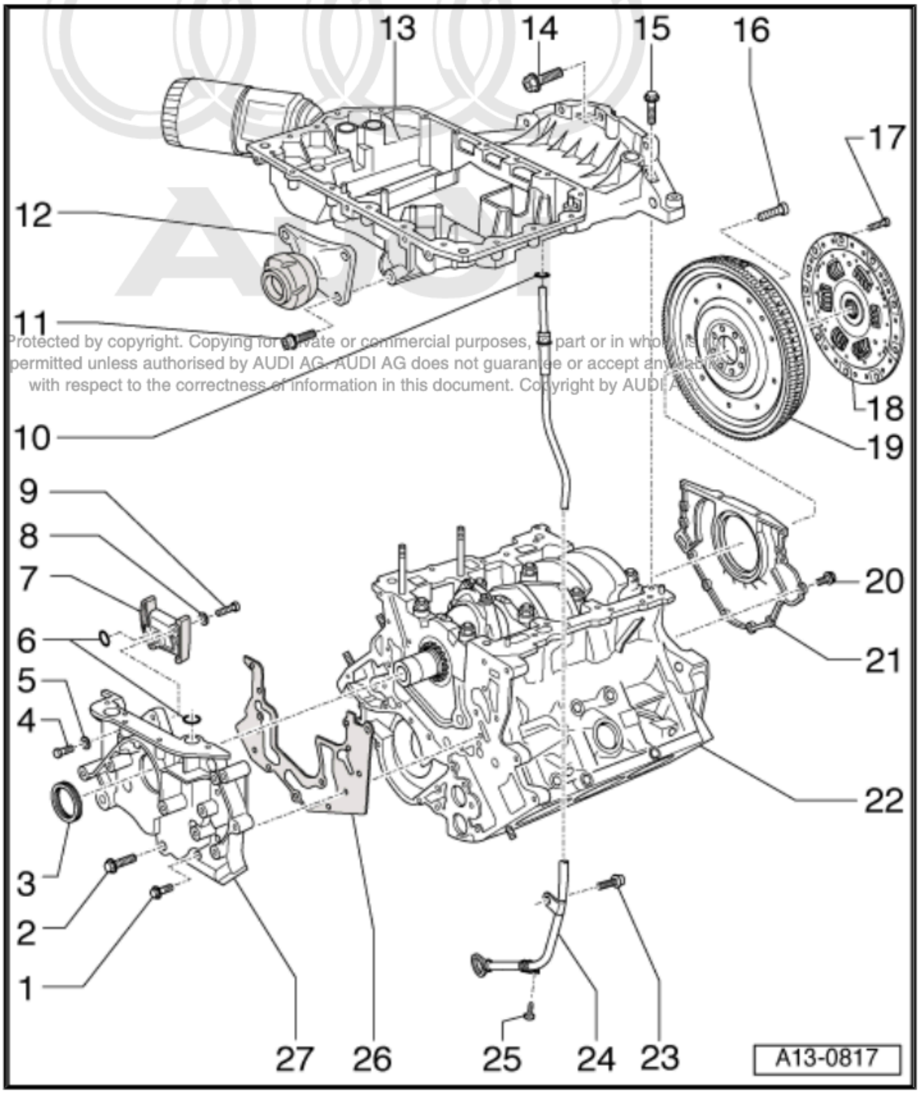
- When installing vibration damper, ensure that notches -arrows- in vibration damper are aligned with locating lugs on toothed belt sprocket.
- Install poly V-belt ⇒ page 33 .

Tightening torque

Component	Nm
Vibration damper to crankshaft	23
Pulley for vane pump to vane pump	23

2 Removing and installing sealing flanges and dual-mass flywheel/flywheel/drive plate

2.1 Sealing flanges and dual-mass flywheel/flywheel/drive plate - exploded view



1 - 10 Nm

2 - 30 Nm
- ☐ Self-locking
- ☐ Renew

3 - Oil seal for crankshaft
- ☐ Removing and installing ⇒ page 40

4 - Screw plug -10 Nm-

5 - Seal
- ☐ Renew

6 - O-ring
- ☐ Renew

7 - Chain tensioner
- ☐ Removing and installing ⇒ page 156

8 - Washer

9 - 12 Nm

10 - O-ring
- ☐ Renew

11 - 40 Nm

12 - Torque reaction support

13 - Sump (top section)
- ☐ Removing and installing ⇒ page 145

14 - 45 Nm

15 - M7 = 16 Nm M8 = 22 Nm

16 - Special bolt
- ☐ Renew
- ☐ Tightening torque ⇒ page 48

17 - Bolt
- ☐ Loosening and tightening ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13

18 - Damper unit for multitronic gearbox
- ☐ Removing and installing ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13

19 - Flywheel
- ☐ Removing and installing ⇒ page 47

20 - 10 Nm

21 - Sealing flange (rear) with oil seal
- ☐ Removing and installing ⇒ page 45
- ☐ Lubricate sealing lip of oil seal lightly
- ☐ To install, push guide sleeve from assembly kit onto crankshaft.

22 - Cylinder block
- ☐ Removing and installing crankshaft ⇒ page 49
- ☐ Dismantling and assembling pistons and conrods ⇒ page 55

23 - 10 Nm

24 - Guide tube for oil dipstick

25 - Panel bolt

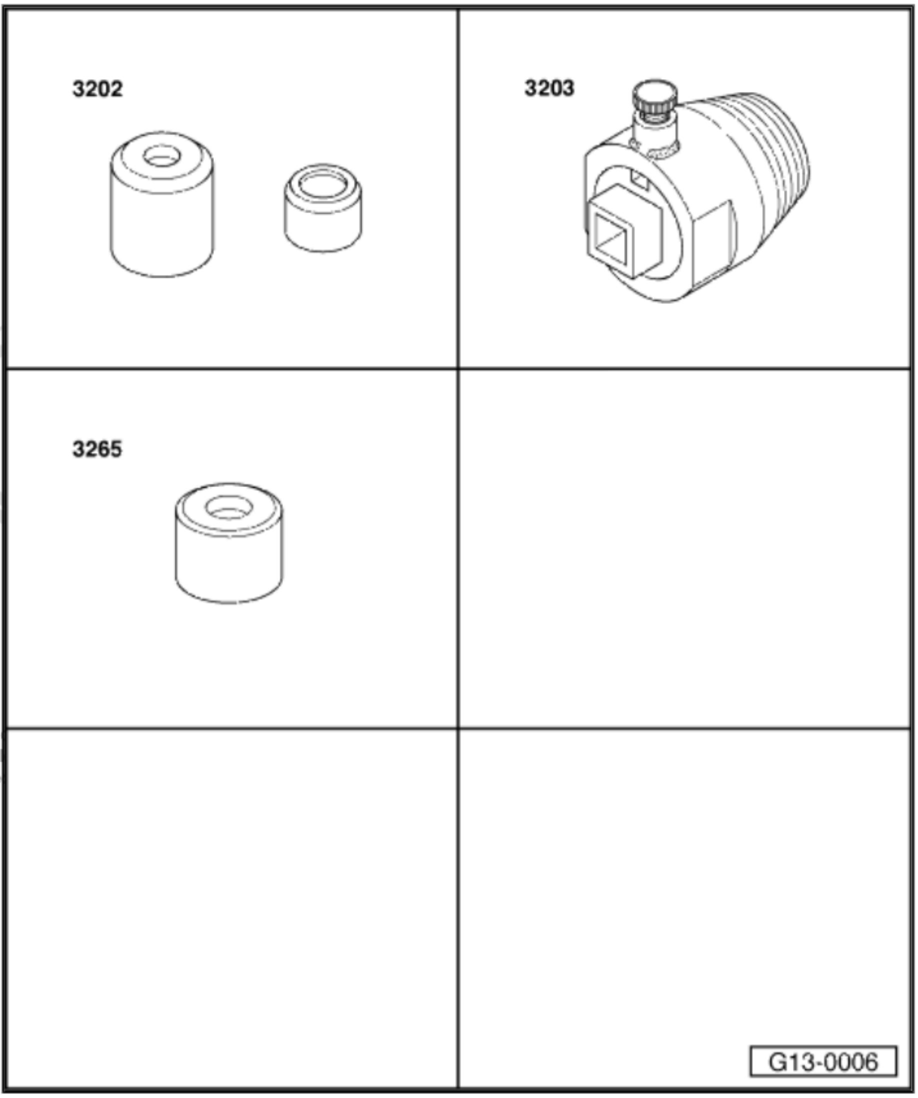
26 - Gasket
- ☐ Renew

27 - Sealing flange (front)
- ☐ Removing and installing ⇒ page 42

2.2 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

- ♦ Fitting sleeve -3202/1-
- ♦ Oil seal extractor -3203-
- ♦ Fitting sleeve -3265-



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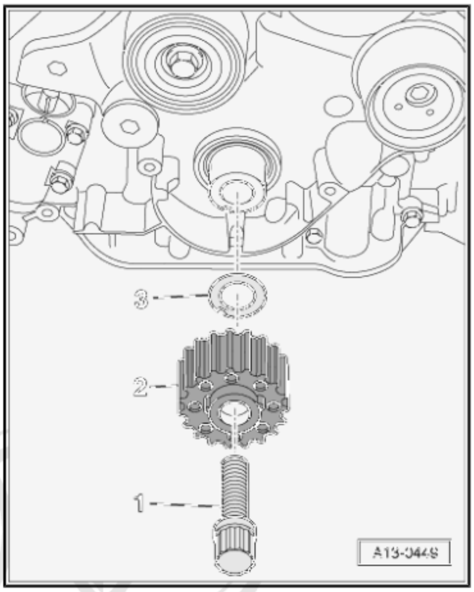
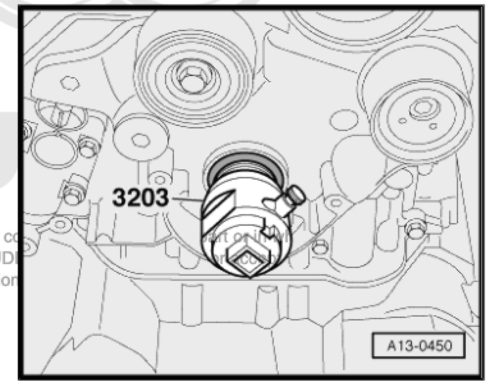
Removing

- Remove toothed belt ⇒ page 62 .
- Unscrew central bolt -1- for crankshaft toothed belt sprocket -2- and remove sprocket.
- Remove diamond-coated washer -3- from toothed belt sprocket.





- Unscrew inner section of oil seal extractor -3203- 6 turns out of outer section and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice.
- Remove oil seal with pliers.

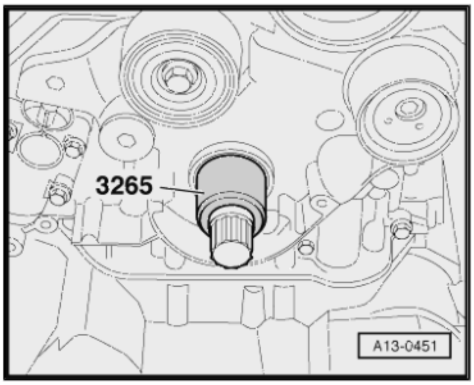
Installing

Note

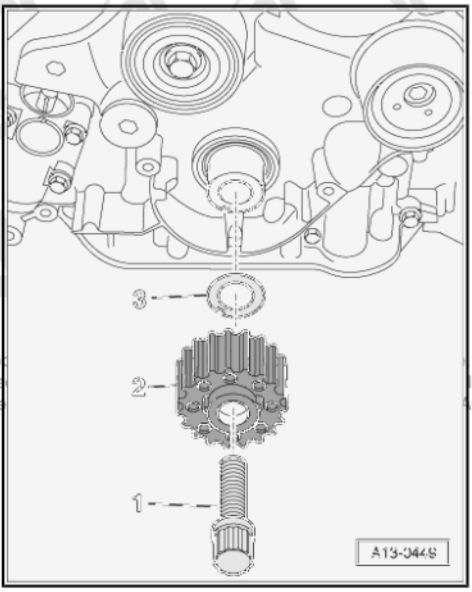
Do not lubricate sealing lip and outer rim of oil seal before pressing in.

- Clean running surface and sealing surface.
- Push on oil seal using fitting sleeve -3202/1- .

- Press oil seal on as far as the stop using fitting sleeve -3265- and central bolt.



– Install crankshaft toothed belt sprocket -2- with new diamond-coated washer -3- and new central bolt -1-.



Note

- *The contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil.*
- *Do not use additional oil on bolt for crankshaft toothed belt sprocket.*

– Install toothed belt (adjust valve timing) ⇒ page 69.

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Tightening torques

Component	Nm
Toothed belt sprocket to crankshaft	200 + 180° 5) 6)

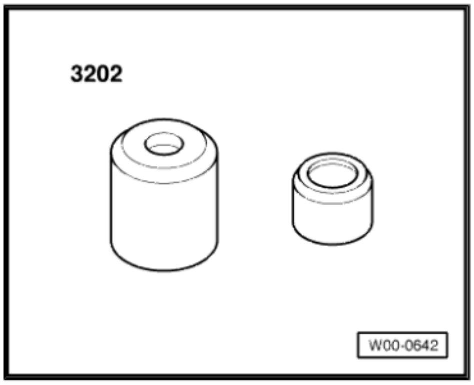
5) Renew bolt.

6) 180° equals half of a turn.

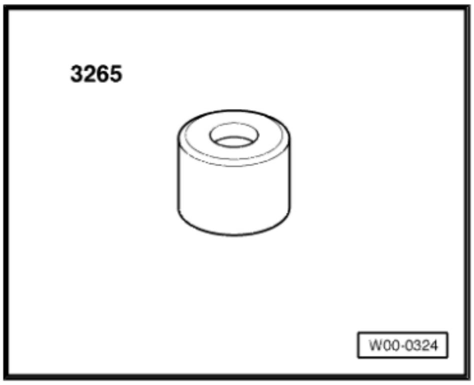
2.3 Removing and installing sealing flange (front)

Special tools and workshop equipment required

- Fitting sleeve -3202/1-

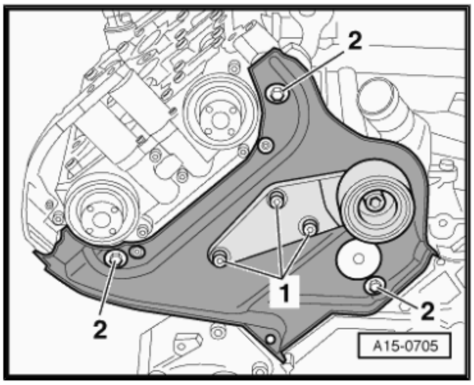


- Fitting sleeve -3265-

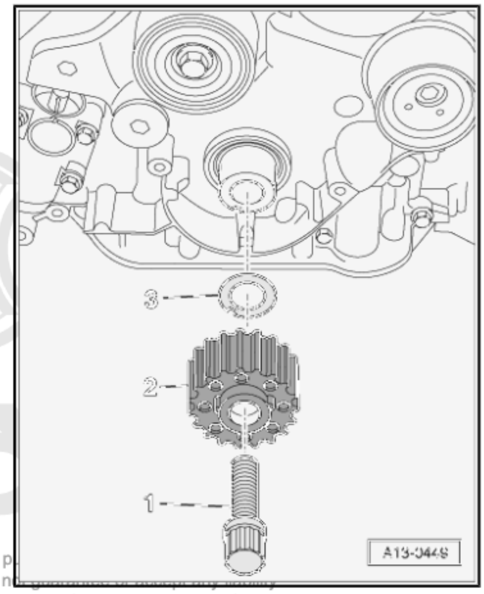


Removing

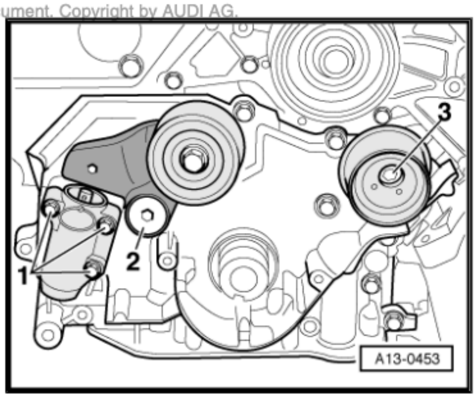
- Remove toothed belt ⇒ page 62 .
- Remove camshaft sprockets (right-side).
- Remove bolts -1- and take off bracket with idler roller.
- Remove bolts -2- and take off toothed belt guard (rear right).
- Remove top section of sump ⇒ page 145 .



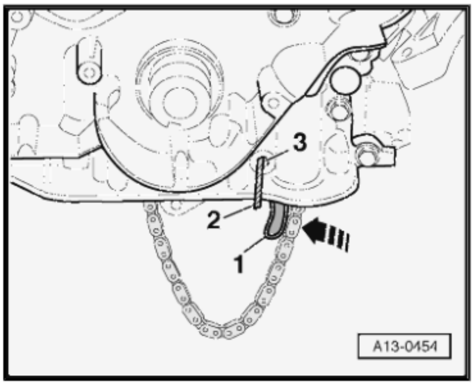
- Unscrew central bolt -1- for toothed belt sprocket -2- on crankshaft.
- Remove toothed belt sprocket and diamond-coated washer -3-.

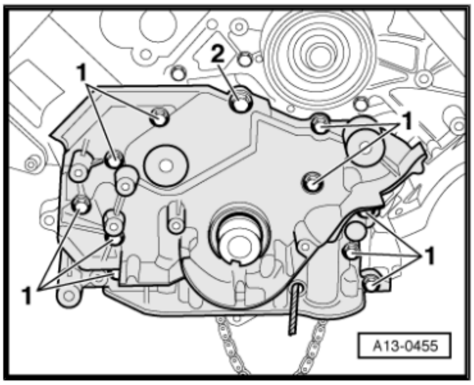


- Unbolt eccentric adjuster -3-, tensioning lever -2- with tensioning roller and tensioning element -1-.



- Unscrew plug from access hole -3-.
- Press chain tensioner -1- in direction of -arrow- until a 3 mm ∅ drill bit -2- can be inserted in the access holes in the sealing flange and the chain tensioner.





- Unscrew bolts -1- and -2-.
- Pull off sealing flange (front).
- Drive out oil seal with flange removed.

Note

The chain tensioner must be removed if the sealing flange is renewed ⇒ page 156 .

Installing

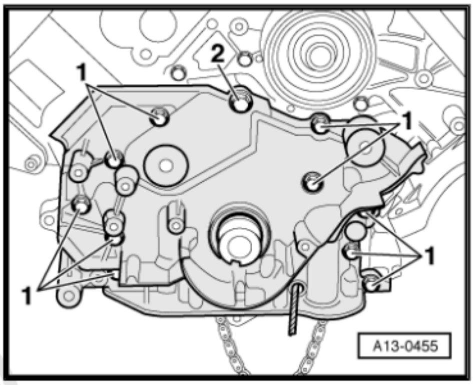
Installation is carried out in the reverse order; note the following:

Note

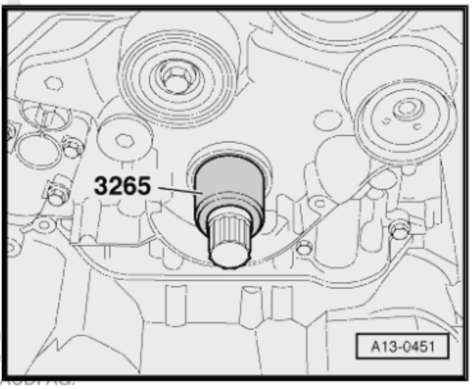
- ◆ *Renew gaskets, seals and self-locking bolts.*
- ◆ *Do not lubricate sealing lip and outer rim of oil seal before pressing in.*

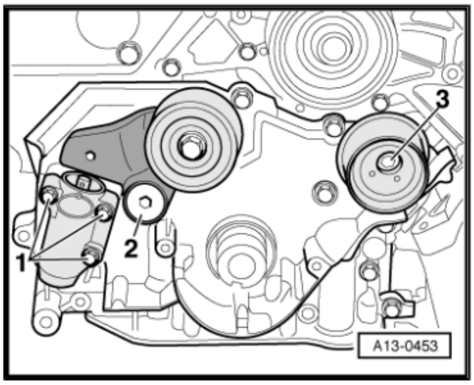
- Clean sealing surfaces before installing sealing flange.
- Install sealing flange (front) with chain tensioner locked in position.

- Renew bolt -2-.



- Tighten bolts -1- to 10 Nm and bolt -2- to 30 Nm.
- Push on oil seal using fitting sleeve -3202/1- .
- Press oil seal on as far as the stop using fitting sleeve -3265- and central bolt.



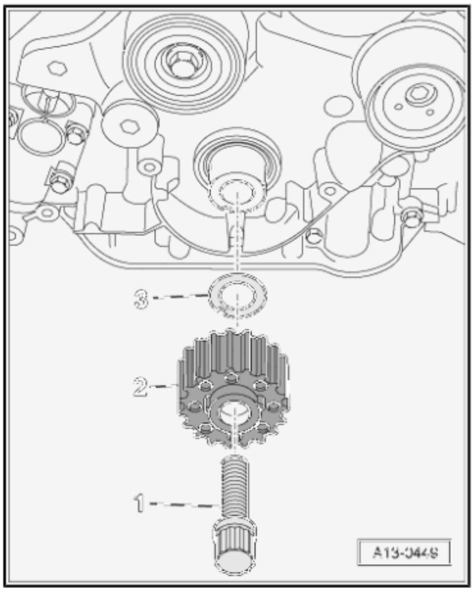


- Install eccentric adjuster -3-, but do not tighten yet.

Note

Note washer fitted under tensioning lever -2-.

- Install tensioning lever -2- with tensioning roller and tensioning element -1-.



- Install crankshaft toothed belt sprocket -2- with new diamond-coated washer -3- and new central bolt -1-.

Note

- *The contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil.*
- *Do not use additional oil on bolt for crankshaft toothed belt sprocket.*

- Install sump (top section) ⇒ page 145 .
- After installing oil pump, pull drill bit out of access hole and screw in sealing plug with a new seal.
- Install toothed belt (adjust valve timing) ⇒ page 69 .

Tightening torques

Component		Nm
Sealing flange (front) to	M6	10
cylinder block	M8	30 [7]
Tensioning lever to sealing flange (front)		45 [7]
Tensioning element to sealing flange (front)		10
Toothed belt sprocket to crankshaft		200 + 180° [7] [8]
Sealing plug for access hole to sealing flange (front)		10

7) Renew bolts.

8) 180° equals half of a turn.

2.4 Removing and installing sealing flange (rear)

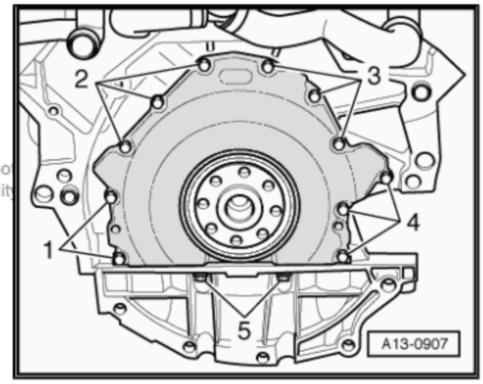
Special tools and workshop equipment required

- Electric drill with plastic brush attachment
- Safety goggles
- Silicone sealant ⇒ Parts catalogue
- Assembly sleeve -T20097-

Removing

- Engine or gearbox removed.

- Remove damper unit ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13 .
- Remove flywheel ⇒ page 47 .
- Unscrew bolts -1 … 5- and remove sealing flange.



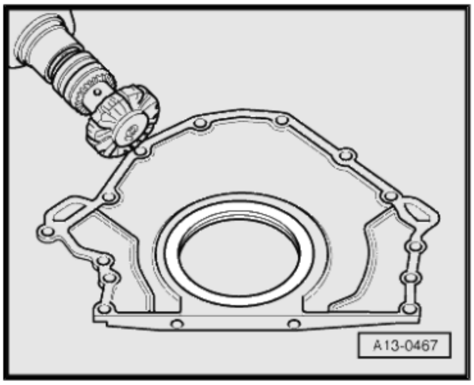
Installing

Installation is carried out in the reverse order; note the following:

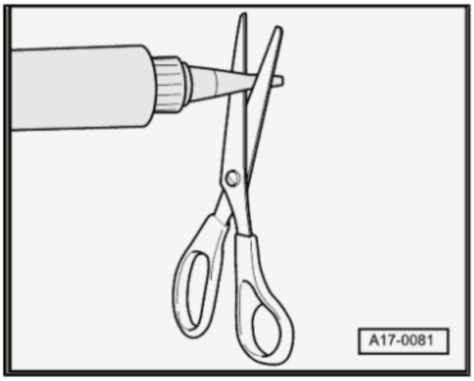
- Remove remaining sealant on rear sealing flange and cylinder block using rotating plastic brush or similar.

WARNING

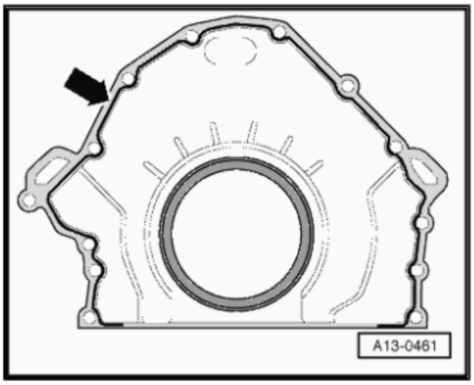
Wear safety goggles.



- Clean sealing surfaces; they must be free of oil and grease.
- Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).

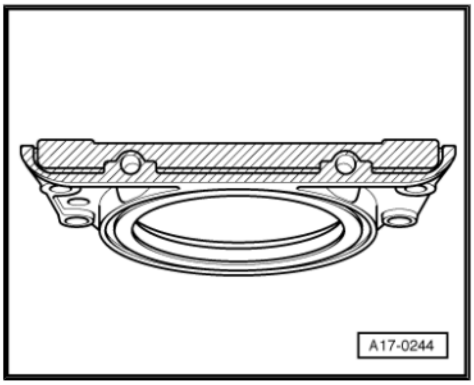


- Apply a bead of silicone sealant onto the clean sealing surfaces of the sealing flange as illustrated.
- The bead of sealant should be approx. 1.5 mm wide -arrow-.

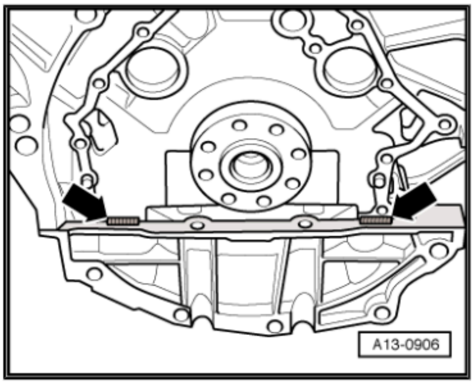


Note

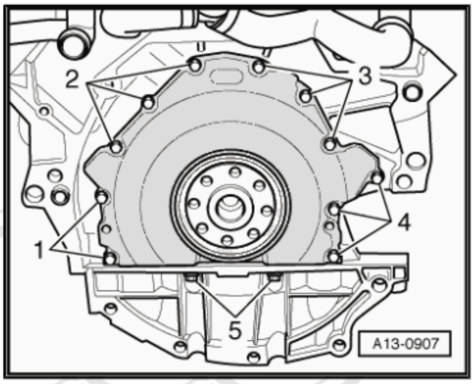
- *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- *The sealing flange must be installed within 5 minutes after applying silicone sealant.*



- Coat the lower sealing surface on the sealing flange lightly with silicone sealant -hatched area-.



- Apply a thin bead of silicone sealant at the edge of the joints between the cylinder block and top section of sump -arrows-.



- Fit assembly sleeve -T20097- onto crankshaft journal.
- Push the sealing flange carefully onto the dowel sleeves on the cylinder block.
- Tighten bolts -1 … 4- to 10 Nm and bolts -5- to 14 Nm.
- Install flywheel ⇒ page 47 .
- Install damper unit ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13 .

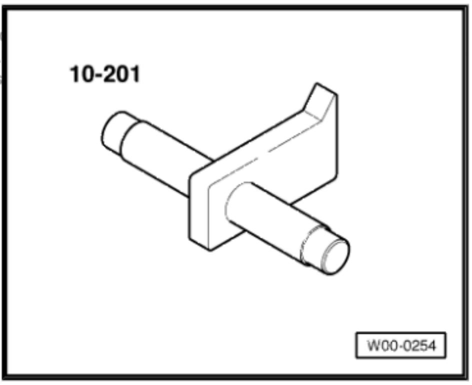
Tightening torque

Component	Nm
Sealing flange (rear) to cylinder block	10
Sealing flange (rear) to top section of sump	14

2.5 Removing and installing flywheel

Special tools and workshop equipment required

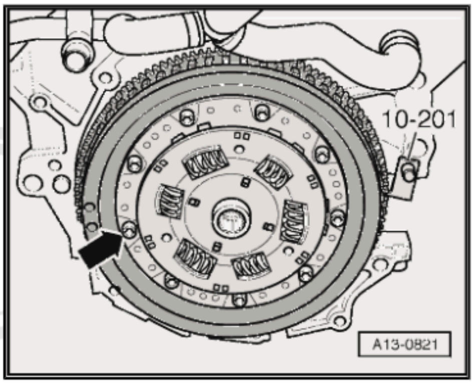
◆ Counterhold -10-201-



Removing

- Engine or gearbox removed.

– Remove damper unit -arrow- ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13 .



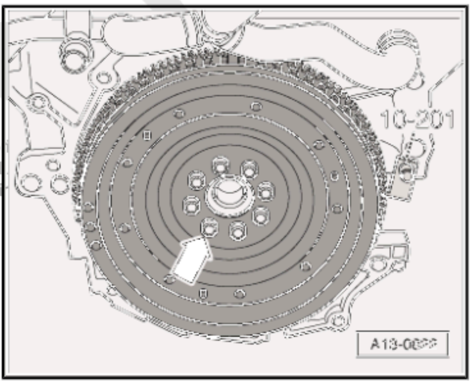
– Mark installation position of flywheel on engine -arrow-.

– Attach counterhold -10-201- in order to loosen bolts.

– Unscrew flywheel.

Installing

Installation is carried out in the reverse order; note the following:



– Use new bolts for securing.

– Attach counterhold -10-201- on other side in order to tighten bolts.

– Install damper unit ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 13 and ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 13 .

Tightening torques

Component		Nm
Flywheel to crankshaft	Bolt length 22.5 mm	60 + 90° [9] [10]

---

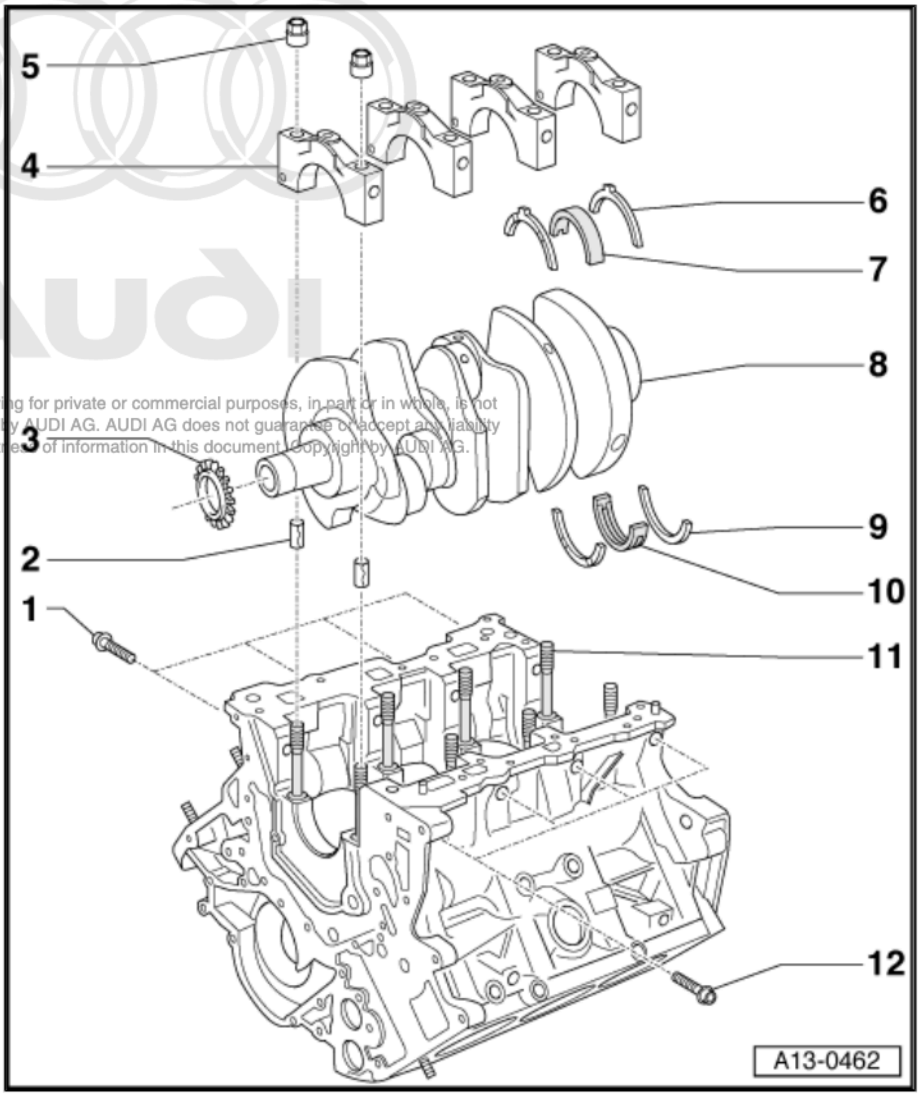
[9] 90° equals a quarter of a turn.

[10] Renew bolts.

3 Removing and installing crankshaft

Note

When carrying out repairs, secure engine to assembly stand with engine and gearbox support -VAS 6095- ⇒ page 28 .



1 - Bolt
- ☐ For bearing cap
- ☐ Renew
- ☐ Tightening sequence ⇒ page 51

2 - Dowel sleeve
- ☐ Insert in cylinder block

3 - Drive chain sprocket for oil pump
- ☐ Removing and installing ⇒ page 53

4 - Bearing cap
- ☐ Note marking ⇒ page 50
- ☐ Removing ⇒ page 50
- ☐ Installing ⇒ page 51

5 - Nut
- ☐ For bearing cap
- ☐ Renew
- ☐ Tightening sequence ⇒ page 51

6 - Thrust washer
- ☐ Only fitted on 4th crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Note location
- ☐ Measuring axial clearance of crankshaft ⇒ page 52

7 - Bearing shell
- ☐ For bearing cap without oil groove
- ☐ Do not interchange used bearing shells (mark)
- ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 51

8 - Crankshaft
- ☐ Measuring axial and radial clearance ⇒ page 52
- ☐ Do not rotate the crankshaft when checking the radial clearance
- ☐ Crankshaft dimensions ⇒ page 52

9 - Thrust washer
- ☐ Only fitted on 4th crankshaft bearing
- ☐ Oil grooves face outwards
- ☐ Measuring axial clearance of crankshaft ⇒ page 52

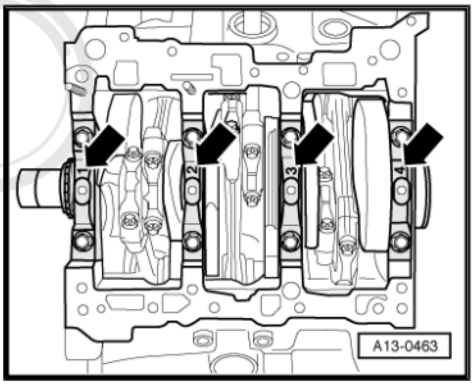
10 - Bearing shell
  - ☐ For cylinder block with oil groove
  - ☐ Do not interchange used bearing shells (mark)
  - ☐ Install new bearing shells for the cylinder block with the correct coloured markings ⇒ page 51

11 - Stud

12 - Bolt
  - ☐ For bearing cap
  - ☐ Renew
  - ☐ Tightening sequence ⇒ page 51

Markings on crankshaft bearing caps

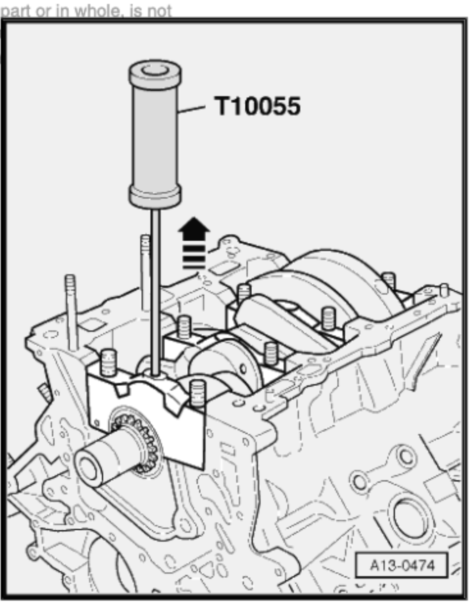
- Bearing 1 is on pulley end.



Removing crankshaft bearing caps

– Remove bolts and nuts for crankshaft bearing caps.

– Pull crankshaft bearing caps off cylinder block using puller -T10055- .



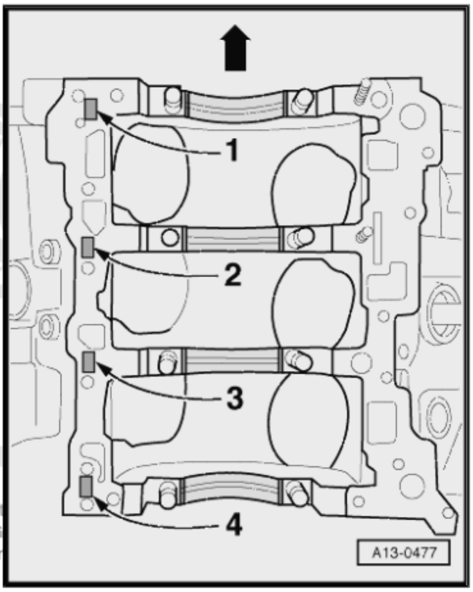
Allocation of crankshaft bearing shells for cylinder block

Bearing shells of the correct thickness are allocated to the cylinder block at the factory. Coloured dots on bearing shell are used to identify bearing shell thickness.

- The -arrow- points to pulley end.

The allocation of the bearing shells to the cylinder block is identified by a code letter next to the relevant bearing.

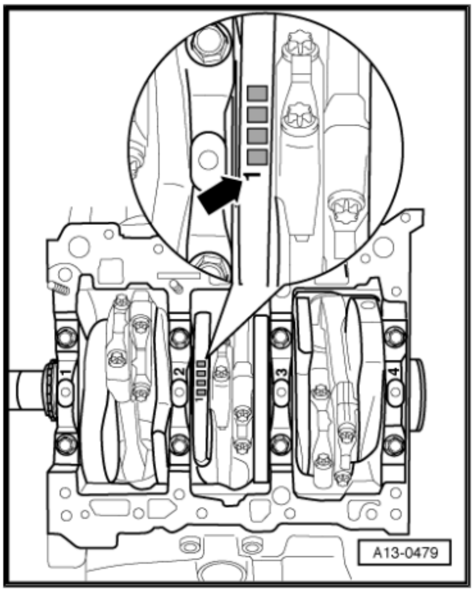
Letter on cylinder block	Colour of bearing
G =	Yellow
B =	Blue
S =	Black



Allocation of crankshaft bearing shells for bearing caps

- ◆ The bearing caps are assigned bearing shells of the correct thickness at the factory. Coloured dots on bearing shell are used to identify bearing shell thickness.
- ◆ The correct allocation of bearing shells to crankshaft is indicated by a sequence of letters on the crankshaft flank. The number “1” -arrow- preceding the sequence of letters indicates the colour code for No. 1 bearing.

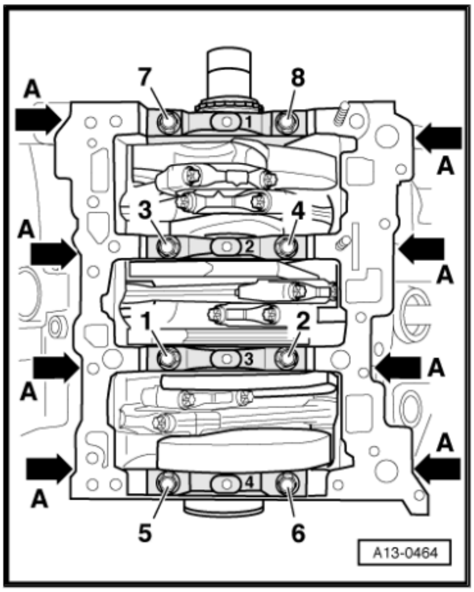
Letter on crankshaft	Colour of bearing
G =	Yellow
B =	Blue
S =	Black



Installing crankshaft bearing caps

- – Renew bolts -A- and nuts -1 … 8-
- – Insert dowel sleeves in cylinder block.
- – Tighten bearing cap nuts and bolts in following sequence:

Stage	Tightening
I	– Screw in bolts -A- finger-tight.
II	– Tighten nuts -1 ... 8- to 35 Nm using torque wrench.
III	– Turn nuts -1 … 8- 90° further ($^{1}/4$ turn) using a rigid wrench.
IV	– Tighten bolts -A- to 20 Nm.
V	– Turn bolts -A- 90° further ($^{1}/4$ turn) using a rigid wrench.



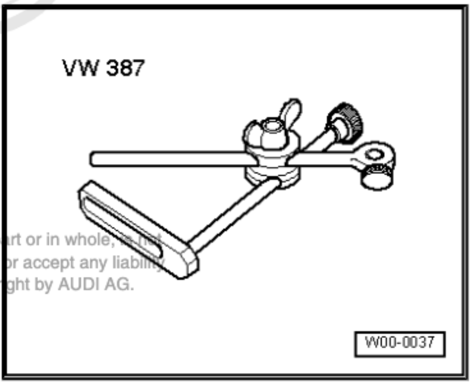
3.1 Crankshaft dimensions

Honing dimension (in mm)	Crankshaft bearing journal ∅	Crankshaft conrod journal ∅
Basic dimension	65.00 - 0.022 - 0.042	54.00 - 0.022 - 0.042
1st undersize	64.75 - 0.022 - 0.042	53.75 - 0.022 - 0.042
2nd undersize	64.50 - 0.022 - 0.042	53.50 - 0.022 - 0.042
3rd undersize	64.25 - 0.022 - 0.042	53.25 - 0.022 - 0.042

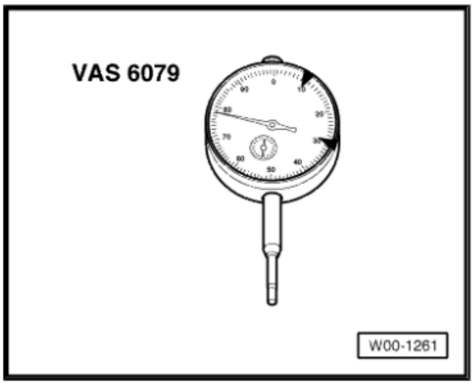
3.2 Measuring axial clearance

Special tools and workshop equipment required

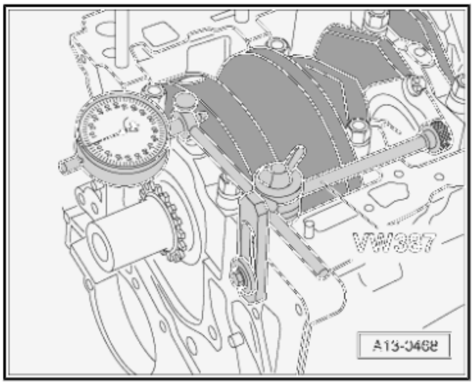
- Universal dial gauge bracket -VW 387-



- Dial gauge -VAS 6079-



Procedure



- Bolt dial gauge -VAS 6079- with universal dial gauge bracket -VW 387- onto cylinder block and set it against crank web.
- Push crankshaft against dial gauge by hand and set gauge to “0”.
- Push crankshaft away from dial gauge and read off value.

Axial clearance:

- New: 0.07 ... 0.23 mm.
- Wear limit: 0.25 mm.

3.3 Measuring radial clearance

Special tools and workshop equipment required

- Plastigage

Procedure

Note

- *Do not interchange used bearings.*
- *Bearing shells worn down to nickel layer must be renewed.*

- Remove main bearing caps and clean bearing caps and journals.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- The Plastigage must rest in the middle of the bearing shell
- Mount main bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- Remove main bearing cap once more.
- Compare width of Plastigage with measurement scale:

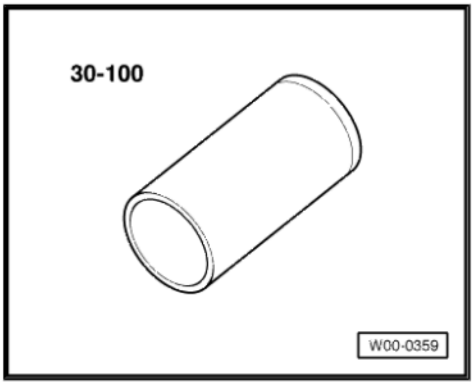
Radial clearance:

- New: 0.018 ... 0.045 mm.
- Wear limit: 0.080 mm.

3.4 Removing and installing drive chain sprocket for oil pump

Special tools and workshop equipment required

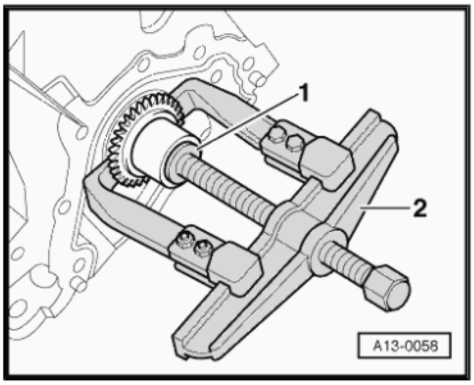
- Fitting sleeve -30-100-



- Two-arm puller, e.g. claw-type puller Kukko 44-1
- Protective gloves

Removing

- Engine removed.
- – Remove sealing flange (front).
- – Pull chain sprocket off crankshaft with a puller -2- (normal commercial type); use a suitable washer -1- to protect end of crankshaft.



Installing

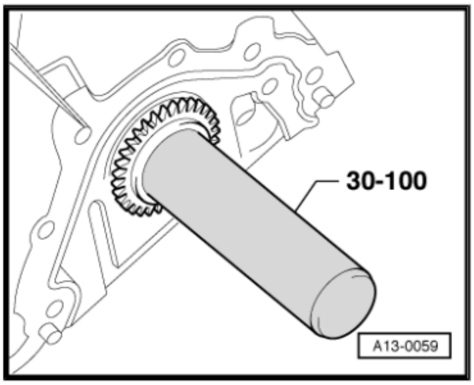
Installation is carried out in the reverse order; note the following:

- – Heat chain sprocket in oven for approx. 15 minutes to 220°C.

WARNING

Wear protective gloves!

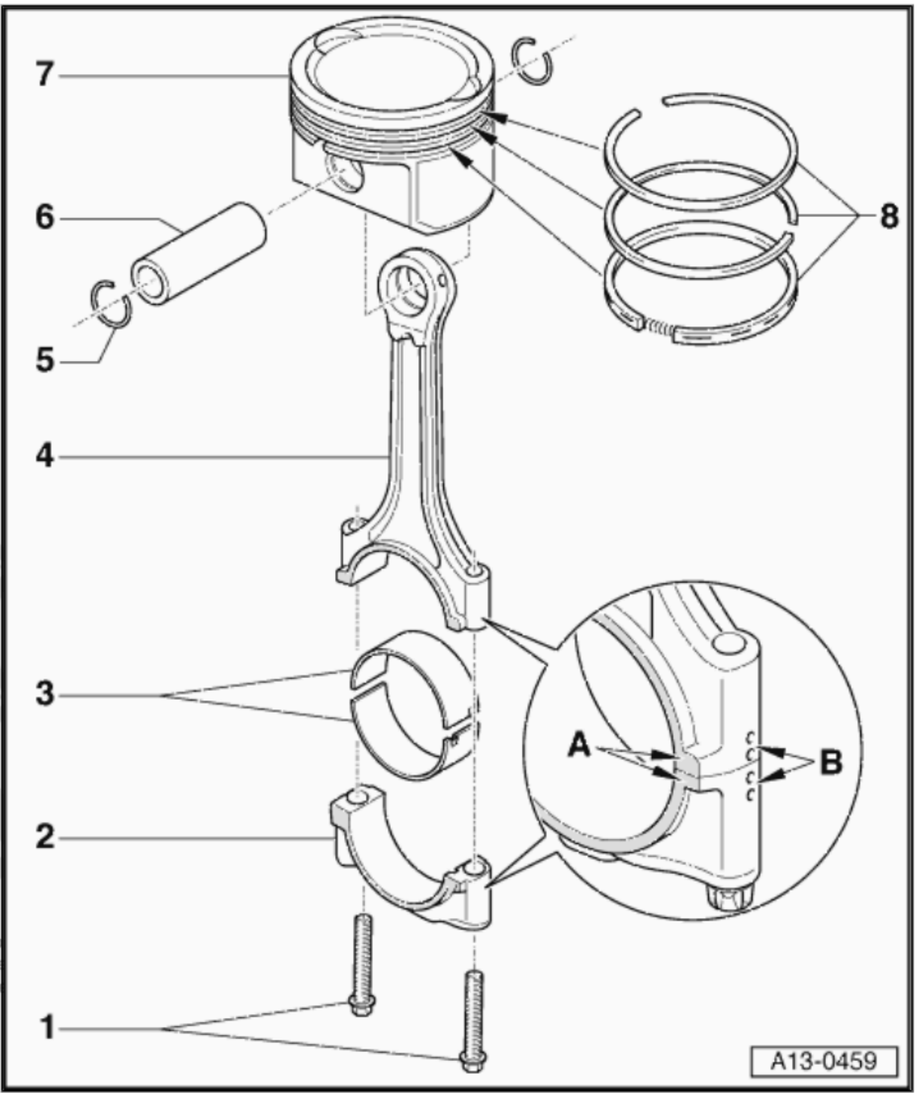
- – Fit chain sprocket on end of crankshaft using pliers, and press onto crankshaft as far as the stop using fitting sleeve -30-100- .



4 Dismantling and assembling pistons and conrods

Note

Oil spray jet for piston cooling ⇒ page 58 .



1 - Conrod bolt - 30 Nm + 90° ($^1/_4$ turn) further
- ☐ Renew
- ☐ Lubricate threads and contact surface
- ☐ To measure radial clearance, tighten to 30 Nm but not further

2 - Conrod bearing cap
- ☐ Do not interchange
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ page 57
- ☐ When installing the bearing cap, the projections on the side of the conrod must be on the same side -A-
- ☐ Installation position of conrod pairs ⇒ page 57

3 - Bearing shell
- ☐ Note installation position
- ☐ Do not interchange used bearing shells (mark)
- ☐ Measuring radial clearance ⇒ page 58
- ☐ To measure radial clearance, tighten bolts ⇒ Item 1 (page 55) to 30 Nm but not further

4 - Conrod
- ☐ Only renew as a set
- ☐ Mark cylinder allocation with a coloured pen -B- ⇒ page 57
- ☐ When installing the bearing cap, the projections on the side of the conrod must be on the same side -A-
- ☐ Installation position of conrod pairs ⇒ page 57

5 - Circlip

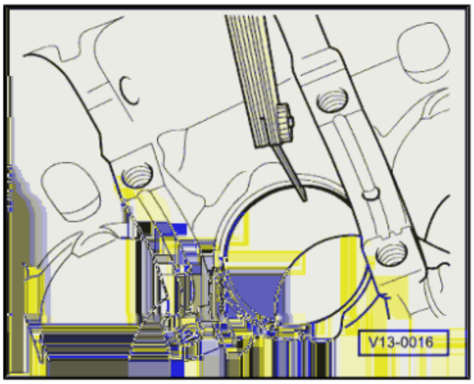
6 - Piston pin
- ☐ If difficult to move, heat piston to 60°C
- ☐ Remove and install using drift -VW 222 A-

7 - Piston
- ☐ Installation position and allocation of piston/cylinder ⇒ page 57

- ☐ Arrow on piston crown points to pulley end
- ☐ Checking ⇒ page 56
- ☐ Install using piston ring clamp
- ☐ Piston and cylinder dimensions ⇒ page 58
- ☐ Checking cylinder bore ⇒ page 57

8 - Piston rings

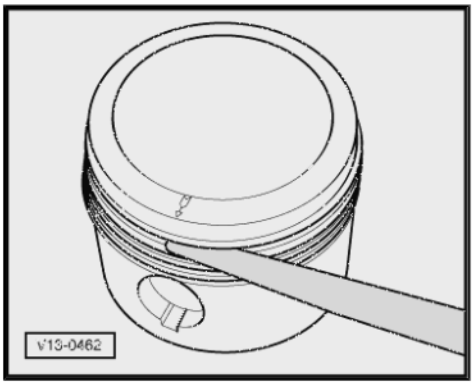
- ☐ Offset gaps by 120°
- ☐ Remove and install using piston ring clamp
- ☐ “TOP” marking or lettering must face towards piston crown
- ☐ Checking ring gap ⇒ page 56
- ☐ Checking ring to groove clearance ⇒ page 56



Checking piston ring gap

– Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder. To do so, use a piston without rings.

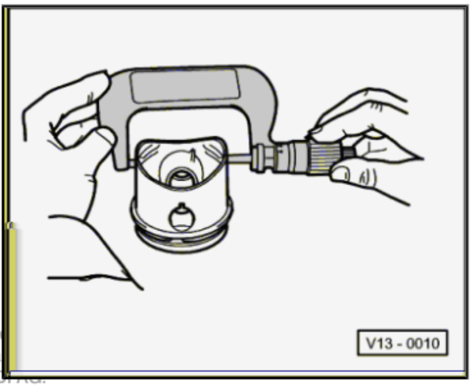
Piston ring (in mm)	New	Wear limit
1st compression ring	0.35 … 0.50	0.8
2nd compression ring	0.60 … 0.80	1.0
Oil scraper ring	0.25 … 0.50	0.8



Checking ring to groove clearance

– Clean groove in piston before checking clearance.

Piston ring (in mm)	New	Wear limit
Compression rings	0.02 … 0.08	0.20
Oil scraper ring	0.02 … 0.08	0.15



Checking piston

– Using a micrometer (75 ... 100 mm), measure approx. 10 mm from the lower edge, perpendicular to the piston pin axis.

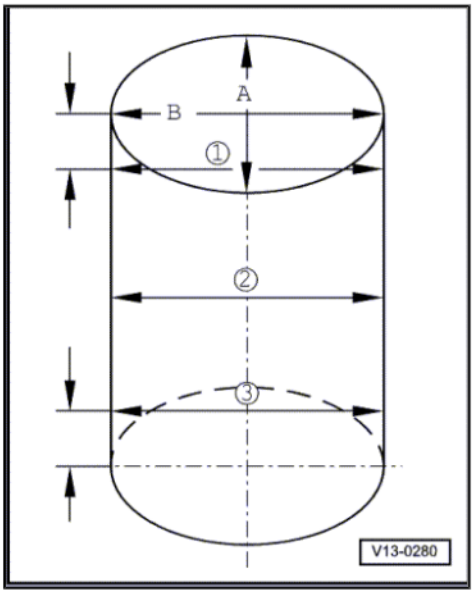
- Max. deviation from nominal dimension: 0.04 mm.

Nominal dimension ⇒ page 58 .

Checking cylinder bore

- – Use 50 ... 100 mm internal dial gauge to take measurements at 3 points in transverse direction -A- and longitudinal direction -B-.
- Max. deviation from nominal dimension: 0.08 mm.

Nominal dimension ⇒ page 58 .



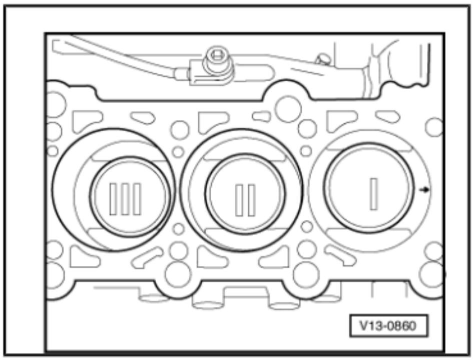
Piston installation position and piston/cylinder allocation

- – Use chalk or waterproof felt-tip pen to mark installation position and cylinder allocation on piston crown.

Note

Do not use a centre punch or scriber, as this would damage the coating of the piston crown.

- Installation position: Arrow on piston crown points to pulley end.

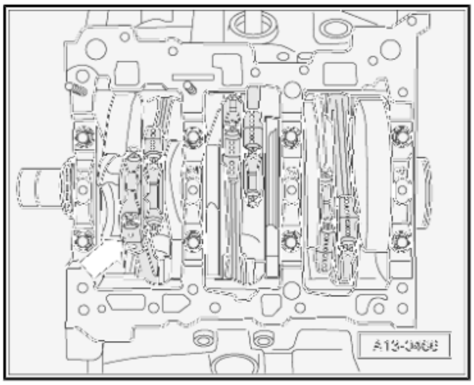


Marking conrods

Note

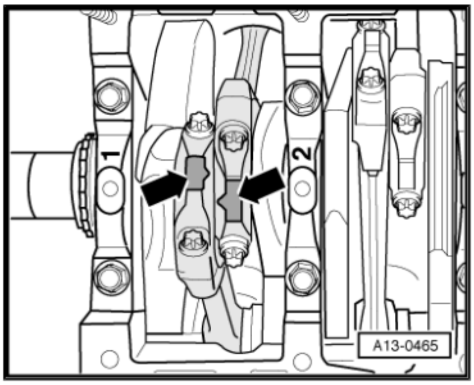
- ♦ *Only renew conrods as a complete set.*
- ♦ *Do not interchange conrod bearings.*

- – Prior to removal, use a coloured pen to mark conrod and conrod bearing cap relative to one another, as well as to cylinder -arrow-.



Conrod installation position

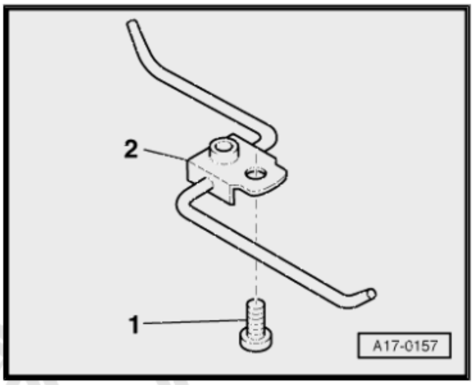
- The cast lugs -arrows- at ground surfaces of conrod pairs 1 and 2, 3 and 4, and 5 and 6 must face one another.



Oil spray jet for piston cooling

1 - Bolt -10 Nm-

2 - Oil spray jet for piston cooling



4.1 Piston and cylinder dimensions

Honing dimension (in mm)	Piston ∅	Cylinder bore ∅
Basic dimension	82.455 [11)]	82.51
Repair oversize	82.955 [11)]	83.01

11) Dimensions not including graphite coating (thickness 0.02 mm). The graphite coating will wear down.

4.2 Checking radial clearance of conrods

Special tools and workshop equipment required

- ♦ Plastigage

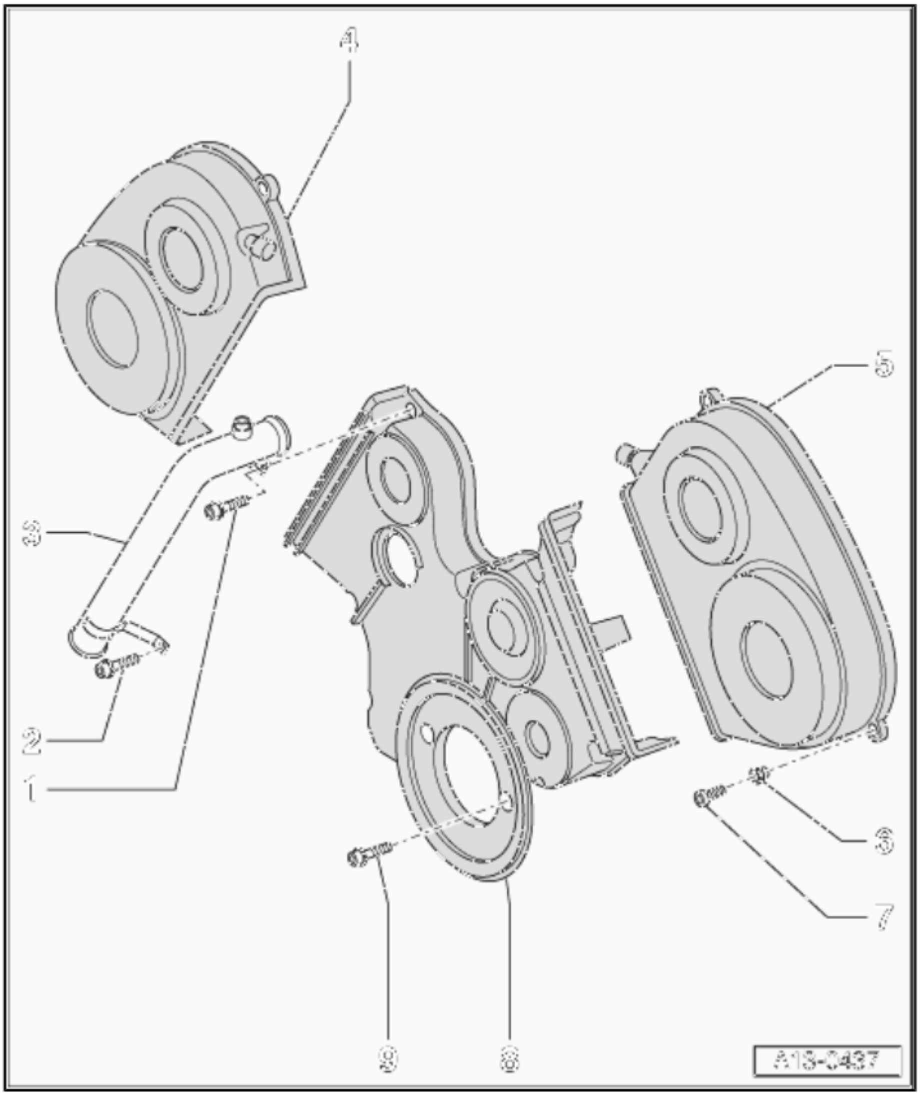
Procedure

- – Remove conrod bearing cap. Clean bearing cap and bearing journal.
- – Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.
- – Fit conrod bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- – Remove conrod bearing cap again.
- – Compare width of Plastigage with measurement scale:
- • Radial clearance (new): 0.015 … 0.062 mm
- • Radial clearance (wear limit): 0.12 mm.
- – Renew bolts for conrod bearings.

15 – Cylinder head, valve gear

1 Toothed belt drive

1.1 Toothed belt covers - exploded view



1 - 10 Nm

2 - 10 Nm

3 - Coolant pipe (front)

- ☐ To remove bottom toothed belt guard, only unscrew bolts ⇒ Item 1 (page 59) and ⇒ Item 2 (page 59)
- ☐ The coolant hoses remain connected to coolant pipe

4 - Toothed belt guard (front right)

5 - Toothed belt guard (front left)

6 - Bush

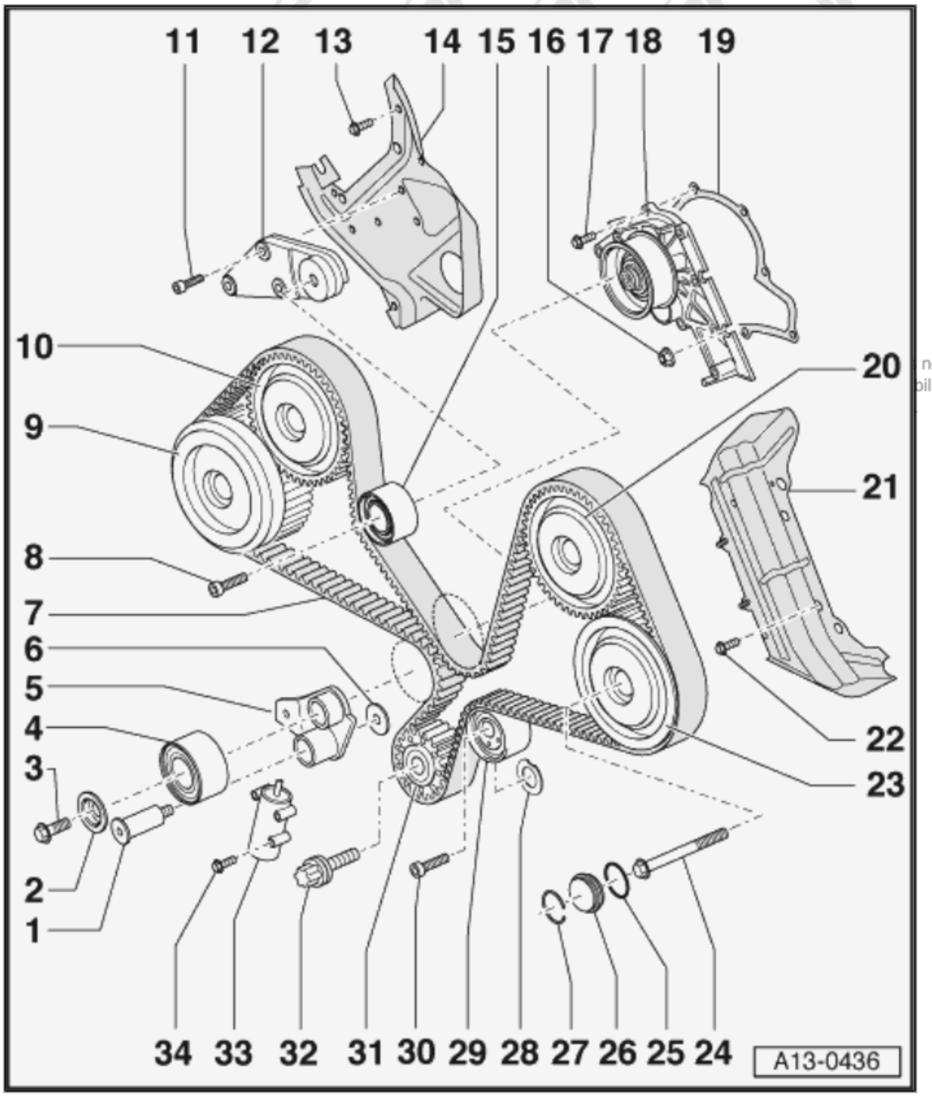
7 - 6 Nm

- ☐ Self-locking
- ☐ Renew

8 - Toothed belt guard - bottom

9 - 10 Nm

1.2 Toothed belt drive - exploded view



1 - 45 Nm
  - ☐ Self-locking
  - ☐ Renew

2 - Washer

3 - 45 Nm

4 - Tensioning roller

5 - Tensioning lever
  - ☐ Insert washer ⇒ Item 6 (page 60) underneath

6 - Washer for tensioning lever

7 - Toothed belt
  - ☐ Before removing, mark direction of rotation with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.
  - ☐ Check for wear
  - ☐ Removing ⇒ page 62
  - ☐ Installing (adjusting valve timing) ⇒ page 69

8 - 45 Nm

9 - Toothed belt sprocket (exhaust camshaft)
  - ☐ For cylinder bank 1 (right-side), with damper
  - ☐ With camshaft adjuster
  - ☐ Identification: “Auslass” (exhaust)

10 - Toothed belt sprocket (inlet camshaft)
  - ☐ For cylinder bank 1 (right-side)
  - ☐ With camshaft adjuster
  - ☐ Identification: “Einlass” (inlet)

11 - 10 Nm
  - ☐ Self-locking
  - ☐ Renew

12 - Bracket for idler roller

13 - 10 Nm
  - ☐ Self-locking
  - ☐ Renew

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bility

14 - Toothed belt guard (rear right)

15 - Idler wheel

16 - 10 Nm

17 - 10 Nm

18 - Coolant pump
- ☐ Removing and installing ⇒ page 169

19 - Gasket
- ☐ Renew

20 - Toothed belt sprocket (inlet camshaft)
- ☐ For cylinder bank 2 (left-side)
- ☐ With camshaft adjuster
- ☐ Identification: “Einlass” (inlet)

21 - Toothed belt guard (rear left)

22 - 10 Nm
- ☐ Self-locking
- ☐ Renew

23 - Toothed belt sprocket (exhaust camshaft)
- ☐ For cylinder bank 2 (left-side), without damper
- ☐ With camshaft adjuster
- ☐ Identification: “Auslass” (exhaust)

24 - 100 Nm
- ☐ Use counterhold -T40030- to loosen and tighten

25 - O-ring
- ☐ Renew

26 - Sealing cap

27 - Circlip

28 - Diamond-coated washer for toothed belt sprocket
- ☐ Renew washer if toothed belt sprocket is removed

29 - Eccentric adjuster

30 - 45 Nm

31 - Crankshaft sprocket

32 - Central bolt: 200 Nm + 180° ($^1/_2$ turn) further
- ☐ Renew
- ☐ Do not additionally lubricate
- ☐ Use locking pin -T40026- when loosening and tightening
- ☐ Screwing in locking pin -T40026- ⇒ page 68
- ☐ Renew diamond-coated washer ⇒ Item 28 (page 61) if removed
- ☐ Contact surfaces between toothed belt sprocket, diamond-coated washer and crankshaft must be free of oil.
- ☐ Can only be installed in one position.
- ☐ Depending on version: with or without thrust washer See note ⇒ page 36

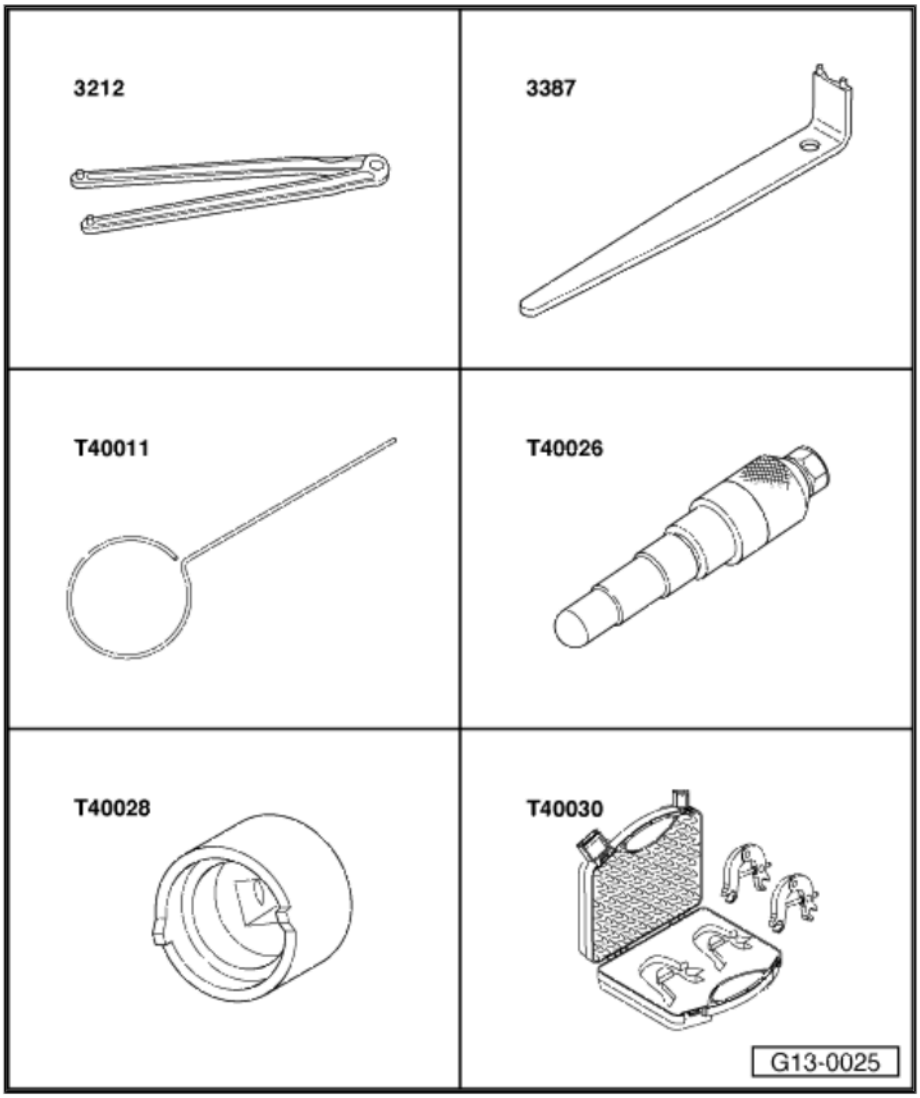
33 - Tensioner for toothed belt

34 - 10 Nm

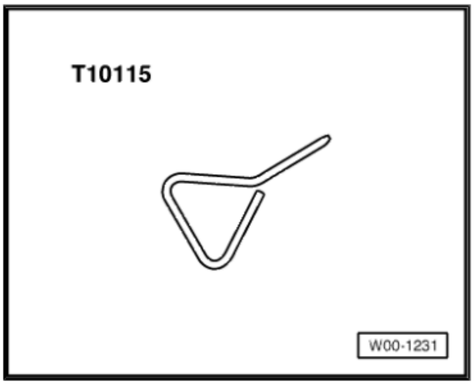
1.3 Removing and installing toothed belt

Special tools and workshop equipment required

- 2-hole pin wrench -3212-
- 2-hole pin wrench -3387-
- Locking pin -T40011-
- Locking pin -T40026-
- Socket -T40028-
- Counterhold -T40030-

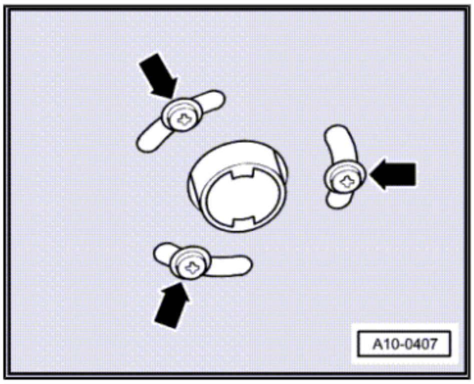


- Locking pin -T10115-

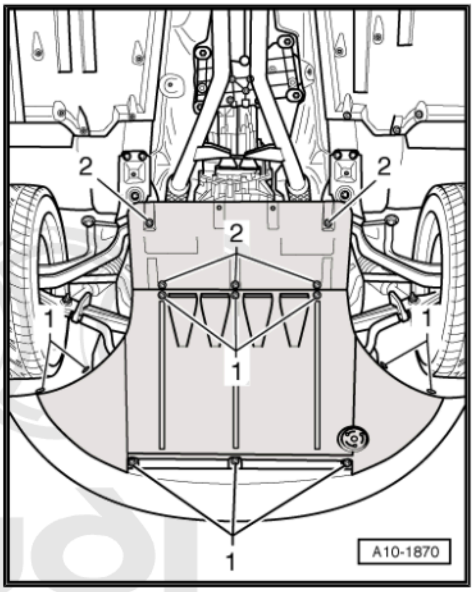


Removing

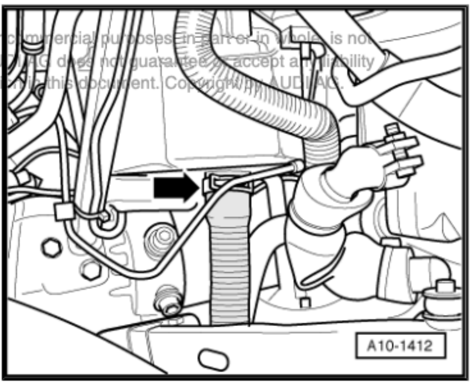
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



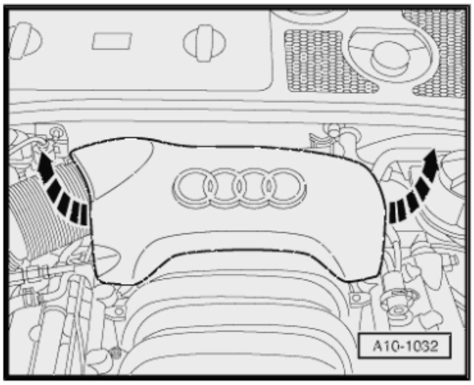
- Loosen quick release fasteners -1- and remove front noise insulation.



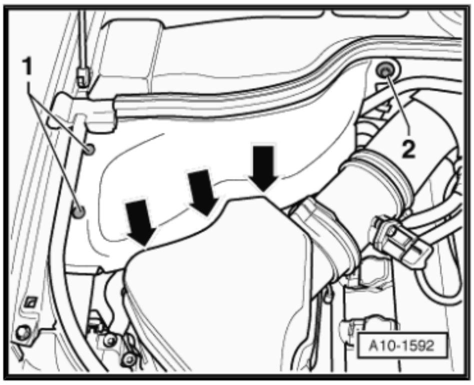
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



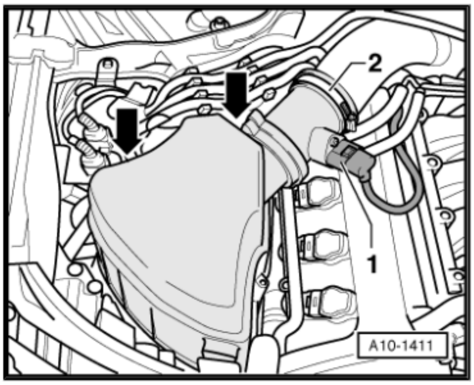
- Pull off rear engine cover -arrows-.



- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.



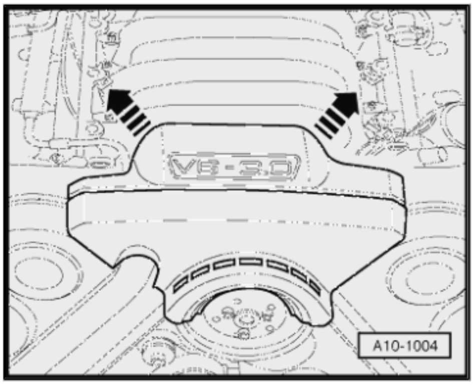
- Detach electrical connector -1-.
- Unscrew bolts -arrows- and remove air cleaner housing.



Note

Ignore item marked -2-.

- Pull off front engine cover -arrows-.



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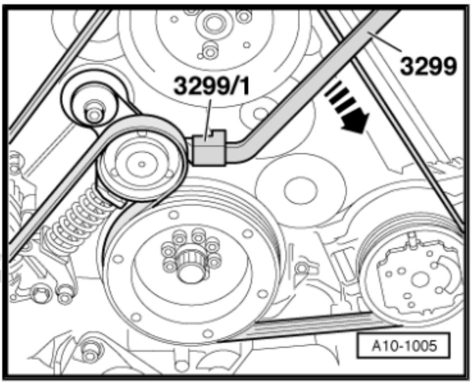
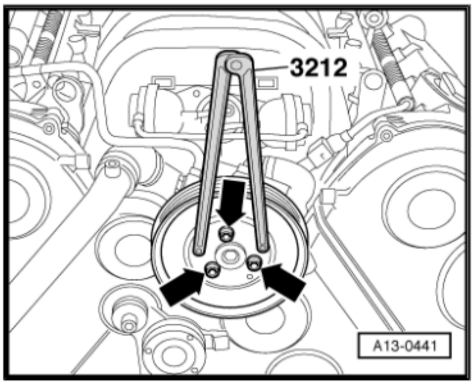
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

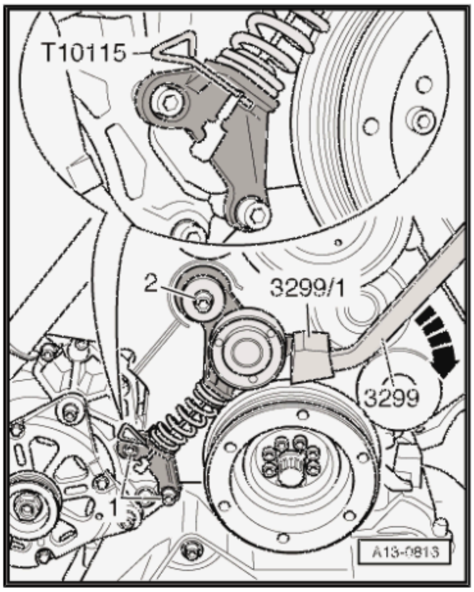


- To slacken the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-.
- Remove poly V-belt from pulley for vane pump.

- Unbolt poly V-belt pulley at vane pump -arrows-, using 2-hole pin wrench -3212- as a counterhold.



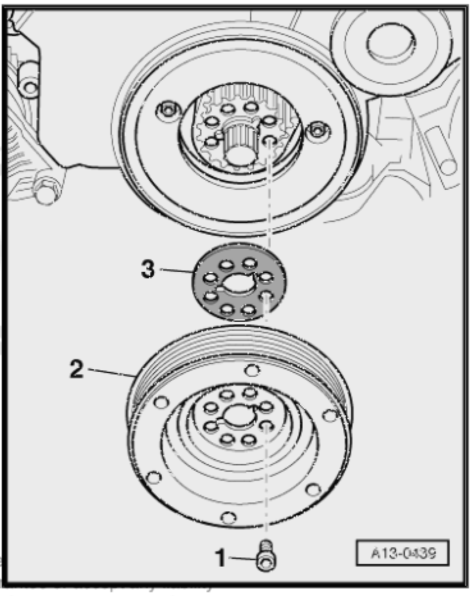
- To lock the tensioner for poly V-belt, apply pressure to tensioner by moving poly V-belt lever -3299- and bracket -3299/1- in the direction of the -arrow-, lock tensioner into place using locking pin -T10115- and release pressure.
- Unscrew bolts -1- and -2- and remove tensioner for poly V-belt (tensioner remains locked).



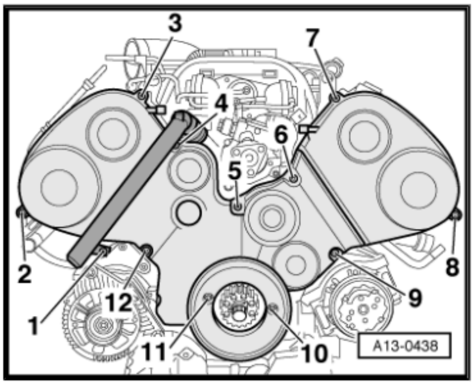
- Unscrew the 8 bolts -1-.
- Remove vibration damper -2- and thrust washer -3-.

Note

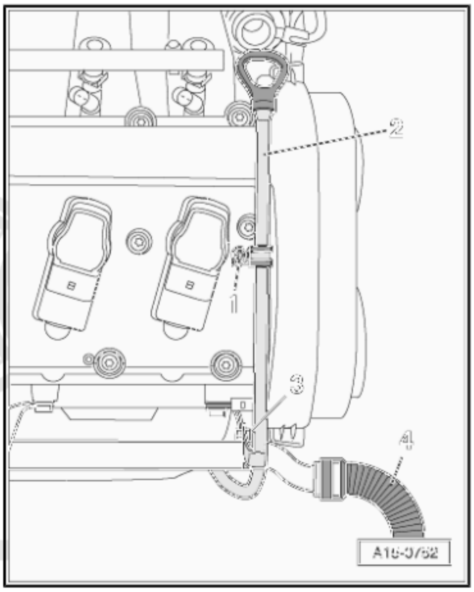
The thrust washer -3- is only fitted in conjunction with toothed belt sprocket -06C 105 063 A- . If toothed belt sprocket -06C 105 063 B- is fitted, do NOT install thrust washer.



- Unscrew bolts -1 … 12- and remove toothed belt guards.



- Unscrew bolts -1- and -3-.
- Disconnect hose -4- at pipe for secondary air.
- Pull guide tube -2- for oil dipstick upwards out of top section of sump and fold forwards.



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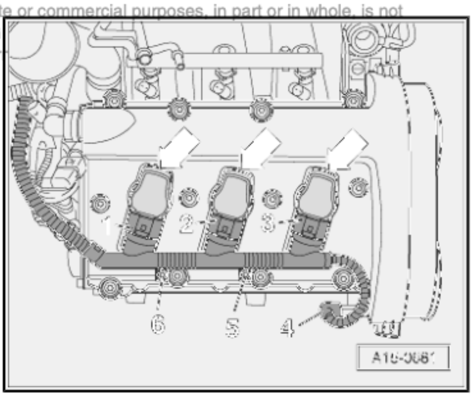
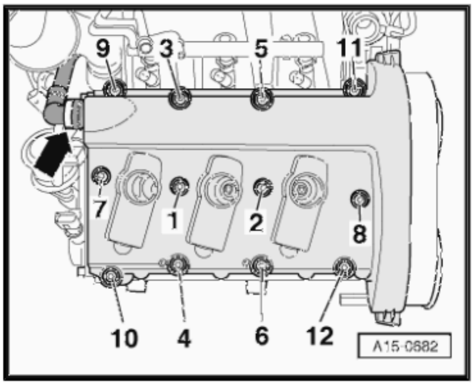
with respect to the correctness of infor

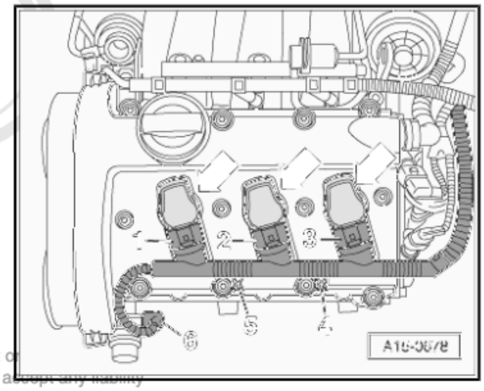
- Unscrew bolts -5- and -6- on cylinder head cover (right-side).
- Unplug electrical connectors -1 … 4-.
- Pull out ignition coils -arrows-.



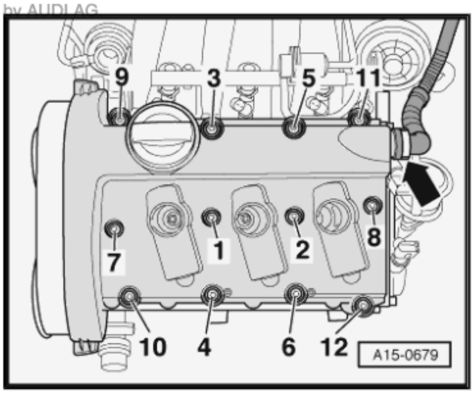
- Detach crankcase breather hose -arrow-.
- Unscrew bolts for cylinder head cover (right-side) in the sequence -12 ... 1- and remove cylinder head cover.



- Unscrew bolts -4- and -5- on cylinder head cover (left-side).
- Unplug electrical connectors -1 ... 3- and -6-.
- Pull out ignition coils -arrows-.



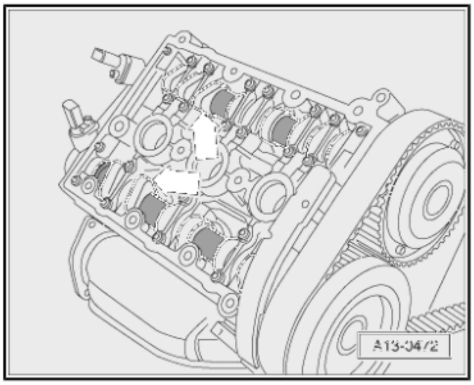
- Detach crankcase breather hose -arrow-.
- Unscrew bolts for cylinder head cover (left-side) in the sequence -12 ... 1- and remove cylinder head cover.



WARNING

The engine must only be turned at the crankshaft, in the direction of normal engine rotation (clockwise).

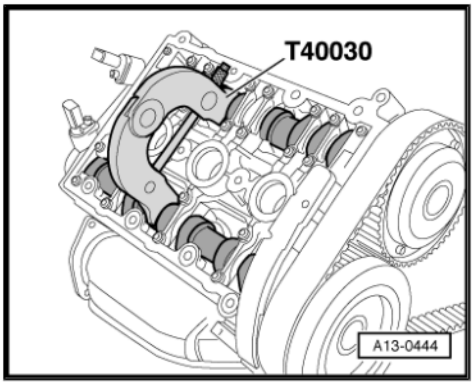
- Turn engine until cams -arrows- of intake and exhaust camshafts at cylinder No. 3 (right-side cylinder bank) point upwards at equal angles.



Note

Turn over the engine at the central bolt on the crankshaft.

- Attach counterhold -T40030- to camshafts of cylinder head (right-side).

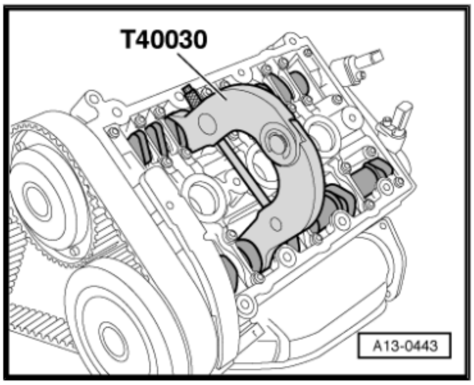


Note

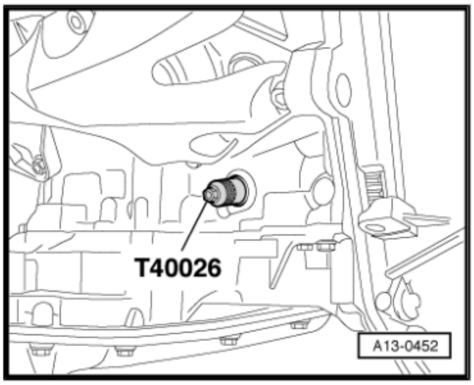
Turn the crankshaft slightly backwards and forwards so that the claws of counterhold -T40030- can engage properly in the camshafts.

- Expand counterhold -T40030- by means of the threaded spindle (tightening torque max. 10 Nm) until it is seated with zero play.

- Attach counterhold -T40030- on cylinder head (left-side) in the same way.



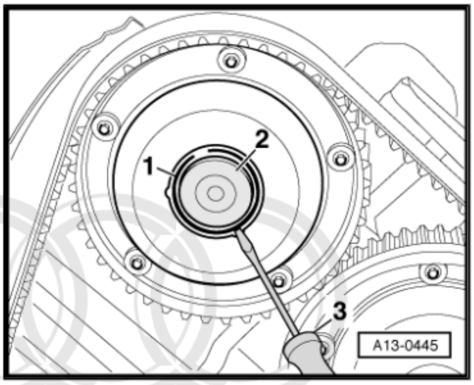
- Unscrew plug for TDC marking from cylinder block.
- Screw in locking pin -T40026- in the hole for the plug and tighten; if necessary, turn the crankshaft backwards and forwards slightly.



Note

Catch escaping oil with a cloth.

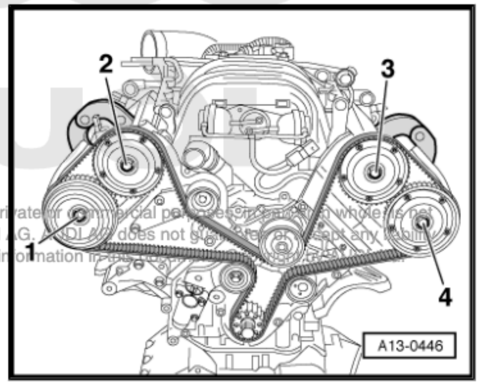
- Pry off circlips -1- for sealing caps -2- on all camshaft sprockets using a screwdriver -3-.



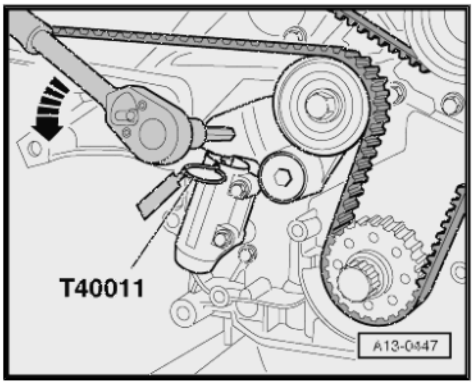
- Loosen securing bolts -1 ... 4- for camshaft sprockets.

Note

Loosen bolts but do not remove.



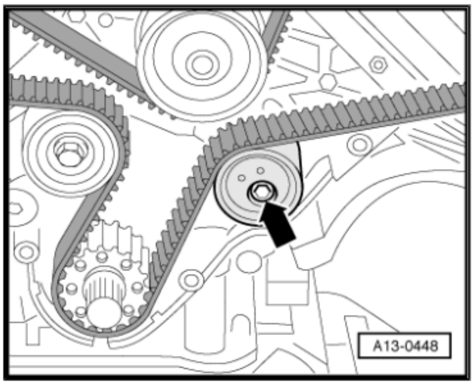
- Turn toothed belt tensioning roller in direction of the arrow using an 8 mm hexagon key until tensioning lever compresses tensioner far enough to allow locking pin -T40011- to be inserted into the holes in the piston and the housing.



Note

- ♦ *The toothed belt tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.*
- ♦ *Mark rotation direction of toothed belt. Running in opposite direction can cause breakage.*

- Loosen bolt -arrow- for eccentric adjuster.



- Remove toothed belt.

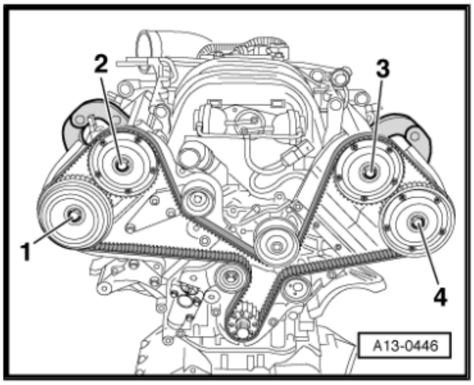
Installing (adjusting valve timing)

- Camshafts locked in position with counterhold -T40030- .
- Crankshaft locked in position with locking pin -T40026- .
- Camshaft sprockets are able to turn.

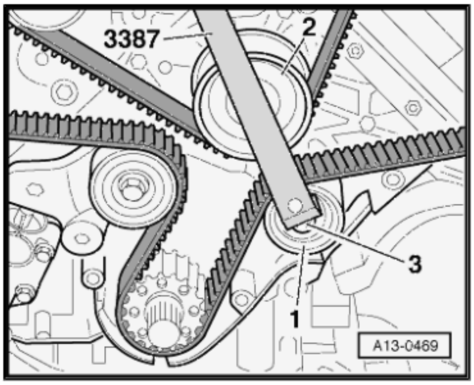
Note

- ♦ *Renew gaskets, seals and self-locking bolts.*
- ♦ *The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise, there is a risk of damage to valves and piston crowns.*

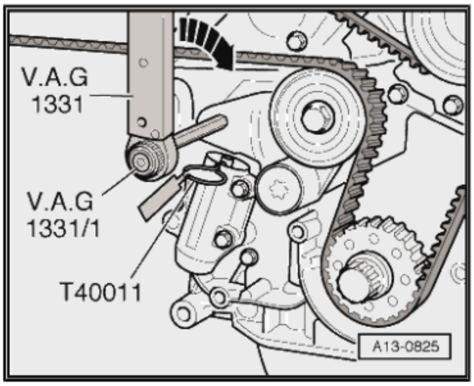
- Tighten the camshaft sprocket bolts until the sprockets -1 … 4- can still just be turned, but do not move axially.
- Fit toothed belt as illustrated.
- To ensure accurate valve timing adjustment, the toothed belt must be exactly in line with the front edge of all belt sprockets.



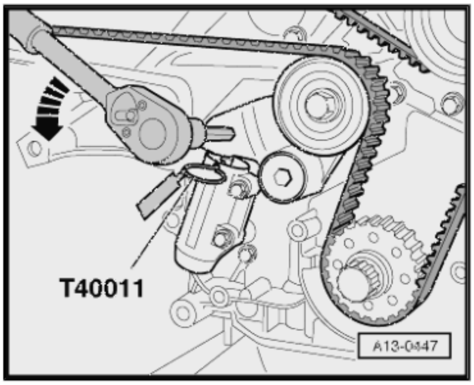
- Using 2-hole pin wrench -3387- , turn the eccentric adjuster -1- clockwise until the handle of the 2-hole pin wrench is exactly over the centre axis of coolant pump pulley -2-.
- Hold the 2-hole pin wrench in this position and tighten bolt -3- to 45 Nm.



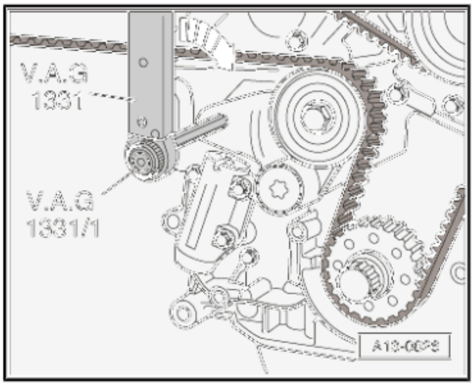
- Apply torque wrench -V.A.G 1331- vertically to hexagon socket of tensioning lever.
- Pre-tension toothed belt by applying a torque of 45 Nm in the direction indicated by the -arrow-.



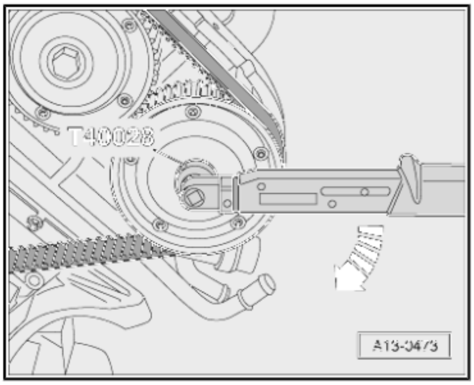
- Turn toothed belt tensioning roller in direction of the -arrow- using an 8 mm hexagon key until the locking pin -T40011- can be removed.



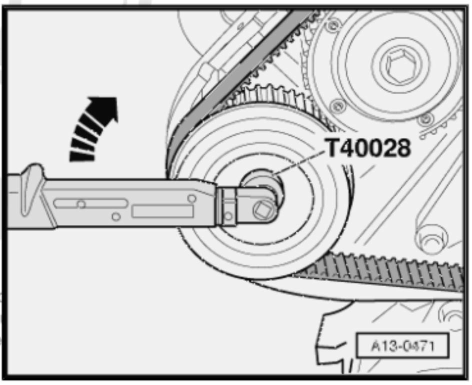
- Apply torque wrench -V.A.G 1331- vertically to hexagon socket of tensioning lever.
- Tension toothed belt by applying a torque of 25 Nm in the direction indicated by the arrow.



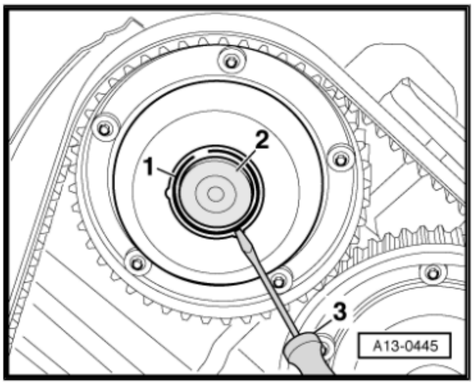
- Apply socket -T40028- to camshaft adjuster for exhaust camshaft on cylinder bank (left-side).
- Turn rotor of camshaft adjuster clockwise as far as it will go -arrow- with a torque of 10 Nm.



- Turn rotor of camshaft adjuster on cylinder bank (right-side) clockwise as far as it will go -arrow- with a torque of 10 Nm.
- Tighten the camshaft sprockets to 100 Nm.



- Insert protective caps -2- with new O-rings into camshaft sprockets and secure with circlip -1-.



Note

Ignore item marked -3-.

- Remove counterhold -T40030- .
- Remove locking pin -T10026- and screw sealing plug for TDC marking into cylinder block with new O-ring seal.

Perform further installation in reverse order, paying attention to the following:

- Install cylinder head cover: left-side ⇒ page 74 , right-side ⇒ page 76 .
- Install toothed belt guards ⇒ page 59 .
- Install vibration damper ⇒ page 36 .
- Install tensioner for poly V-belt ⇒ page 35 .
- Install poly V-belt ⇒ page 33 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

Tightening torques

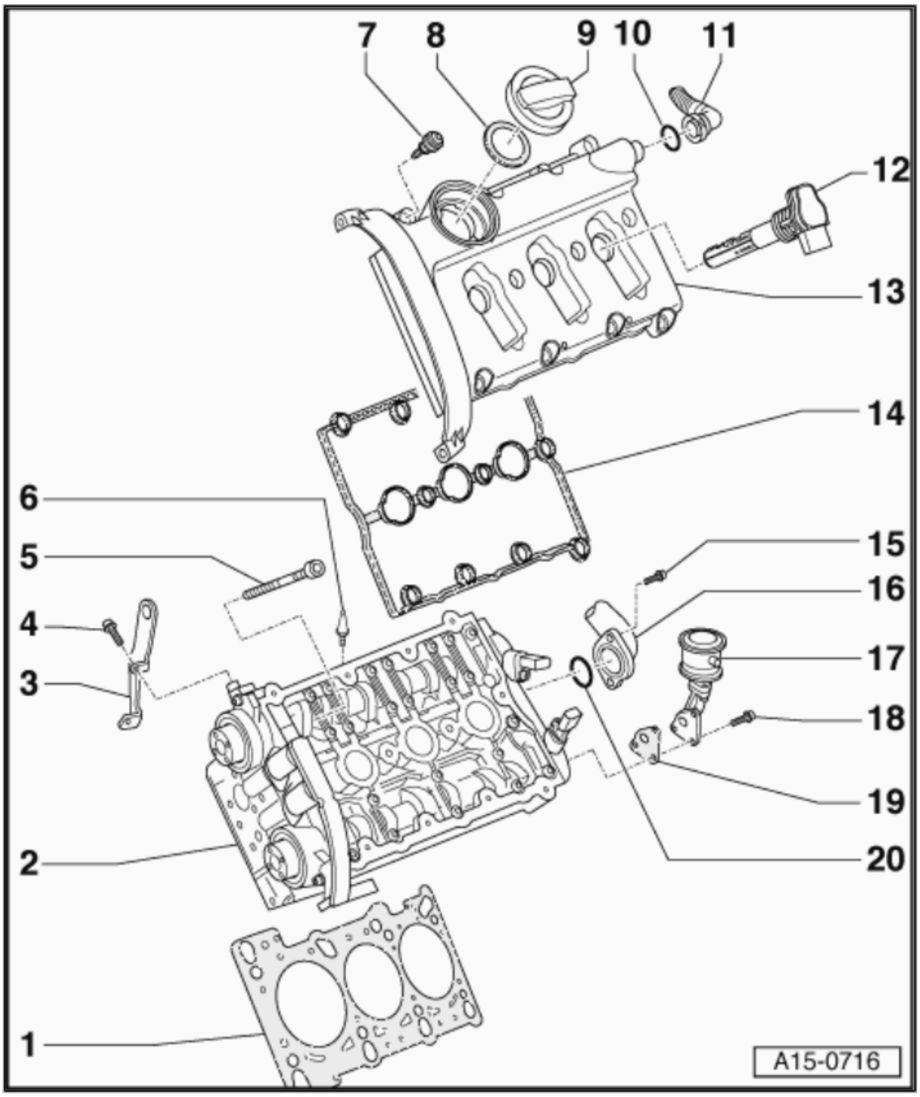
Component	Nm
Eccentric adjuster to front sealing flange	45
Camshaft sprocket to camshaft	100
Sealing plug in cylinder block	25

2 Removing and installing cylinder head

Note

- *Renew the cylinder head bolts.*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *When installing an exchange cylinder head with fitted camshafts, the contact surfaces between bucket tappets and cams must be oiled after installing the head.*
- *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- *When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and refill with new coolant.*
- *When renewing a cylinder head, a sealing cap (core plug) must be driven into the front of the cylinder head ⇒ page 74 .*
- *Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.*

2.1 Cylinder head - exploded view of components



1 - Cylinder head gasket
- ☐ Renew ⇒ Removing cylinder head ⇒ page 79 onwards
- ☐ Installation position: Part No. towards cylinder head
- ☐ After replacing, fill with new coolant

2 - Cylinder head
- ☐ Removing cylinder head (left-side) ⇒ page 79
- ☐ Removing cylinder head (right-side) ⇒ page 83
- ☐ Checking for distortion ⇒ page 74
- ☐ Machining dimension ⇒ page 74
- ☐ Driving sealing cap into cylinder head ⇒ page 74
- ☐ Installing ⇒ page 88
- ☐ After replacing, fill with new coolant

3 - Lifting eye

4 - 23 Nm

5 - Cylinder head bolt
- ☐ Renew
- ☐ Note sequence when loosening ⇒ page 83 and ⇒ page 87
- ☐ Note sequence when tightening ⇒ page 90

6 - Centering pin for intake manifold

7 - Special bolt -10 Nm-
- ☐ Renew if damaged or leaking
- ☐ Note sequence when tightening ⇒ page 76 and ⇒ page 79

8 - Seal
- ☐ Renew if damaged or leaking

9 - Filler cap

10 - O-ring
- ☐ Renew

11 - Crankcase breather hose

12 - Ignition coil

13 - Cylinder head cover
- ☐ Removing and installing: left-side ⇒ page 74 , right-side ⇒ page 76

14 - Gasket for cylinder head cover
- ☐ Renew if damaged or leaking

15 - 10 Nm

16 - Coolant pipe (rear)

17 - Combination valve for secondary air

18 - 10 Nm

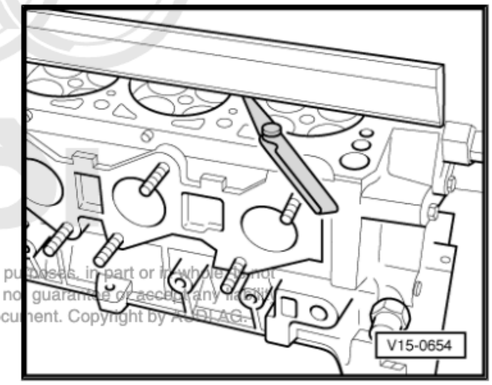
19 - Gasket
- ☐ Renew

20 - O-ring
- ☐ Renew

Checking cylinder head for distortion

– Use straight edge and feeler gauge to measure for distortion at several points.

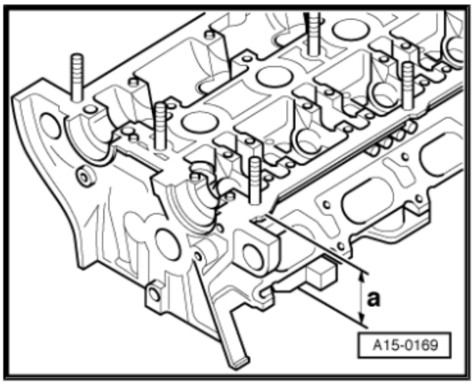
• Max. permissible distortion: 0.1 mm



Cylinder head machining limit

– Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

• Minimum dimension: -a- = 139.25 mm

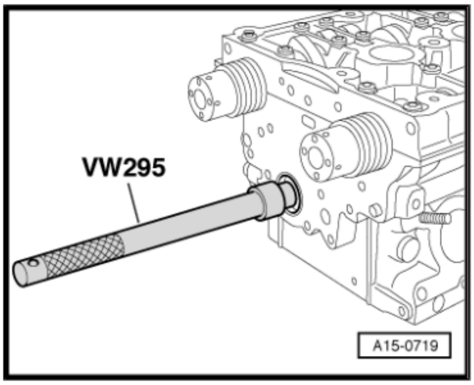


Driving sealing cap into cylinder head

Replacement cylinder heads can be used on both the left and right-side and must be fitted with a sealing cap on the appropriate front side.

– Coat edge of sealing cap with sealant; sealant ⇒ Parts catalogue

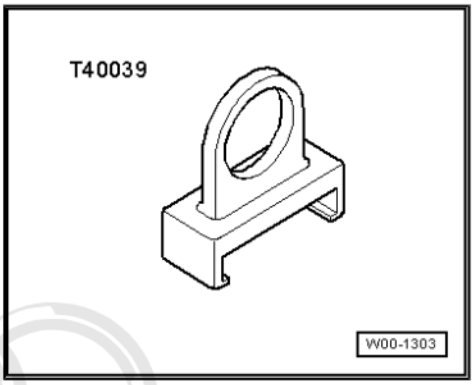
– Use drift -VW 295- to drive sealing cap into cylinder head until flush.



2.2 Removing and installing cylinder head cover (left-side)

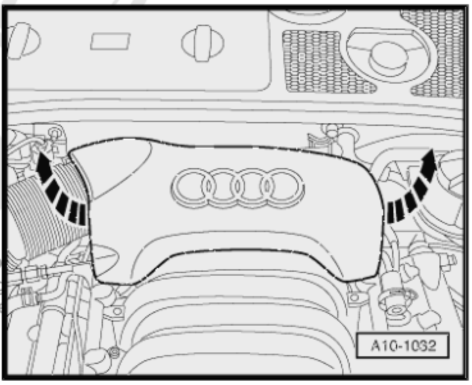
Special tools and workshop equipment required

- Puller -T40039-

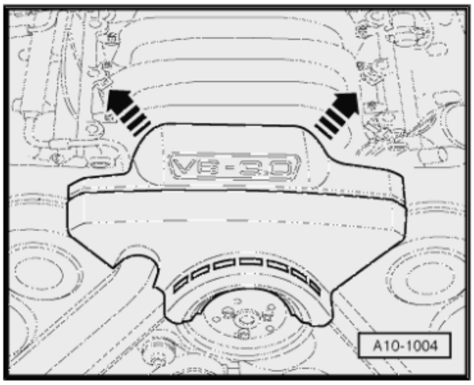


Removing

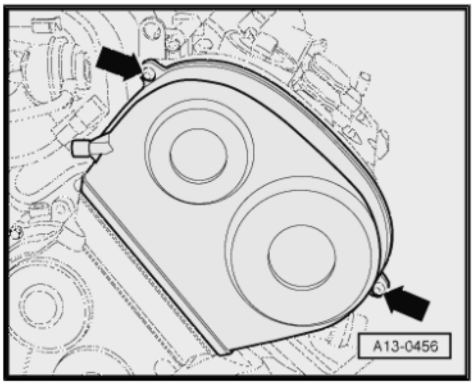
– Pull off rear engine cover -arrows- ...



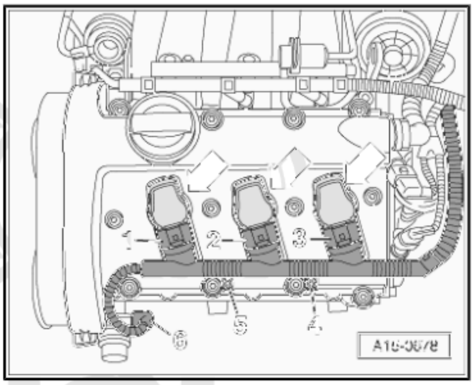
– ... as well as front engine cover -arrows-.



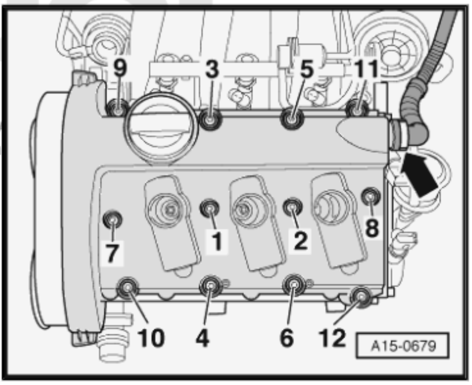
– Unbolt toothed belt guard (front left) from cylinder head cover -arrows-.



- Unscrew bolts -4- and -5-.
- Unplug electrical connectors -1 ... 3- and -6-.



- Detach crankcase breather hose -arrow-.
- Unscrew bolts for cylinder head cover (left-side) in the sequence -12 ... 1- and remove cylinder head cover.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew self-locking bolts.*
- *Renew gasket for cylinder head cover if damaged.*

- Tighten bolts for cylinder head cover in the sequence -1 ... 12-.

Tightening torques

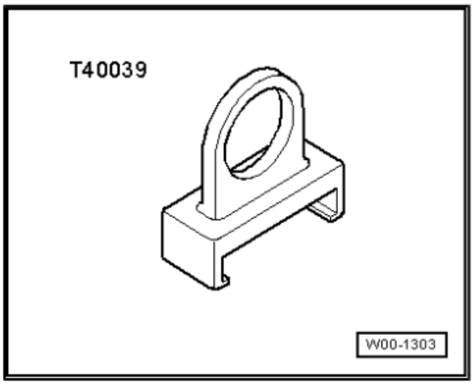
Component	Nm
Cylinder head cover to cylinder head	10
Toothed belt guard (front) to cylinder head cover	6 [12]

[12] Renew bolts.

2.3 Removing and installing cylinder head cover (right-side)

Special tools and workshop equipment required

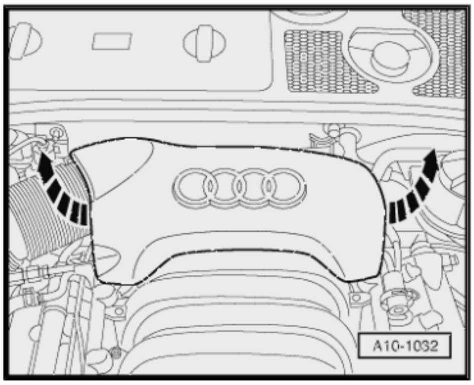
- Puller -T40039-



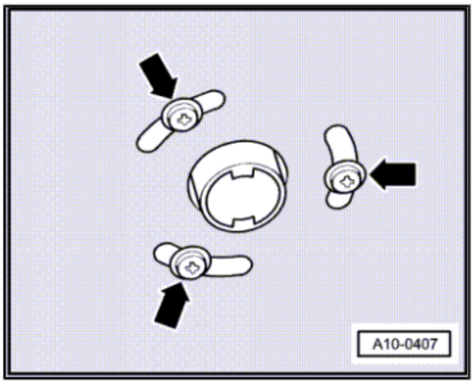
Removing

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

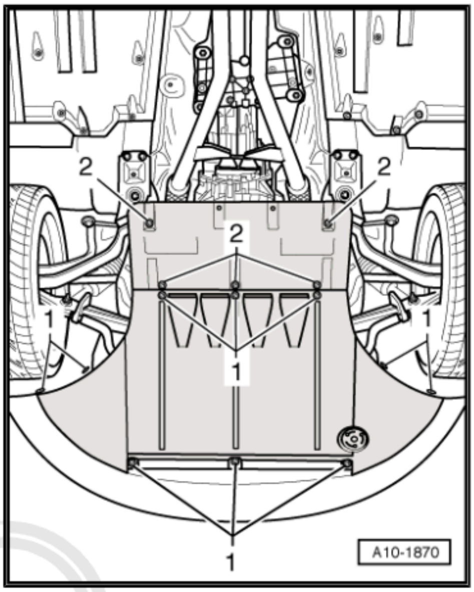
– Pull off rear engine cover -arrows-.



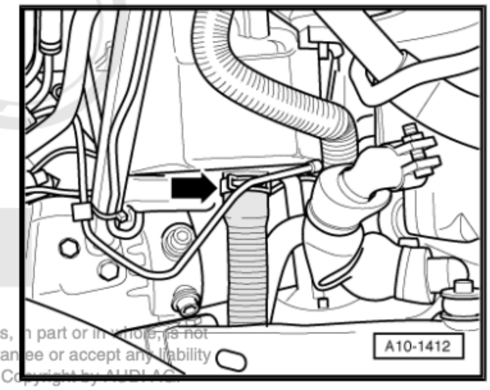
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



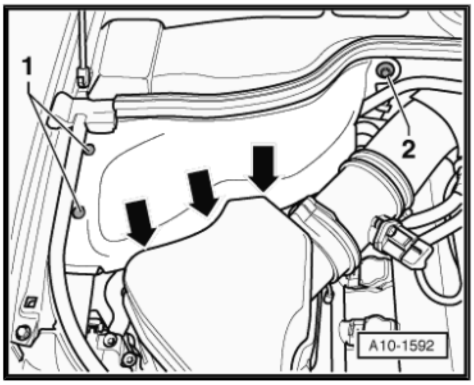
– Loosen quick release fasteners -1- and remove front noise insulation.



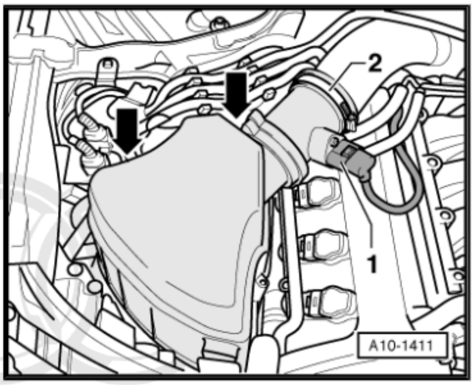
– Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



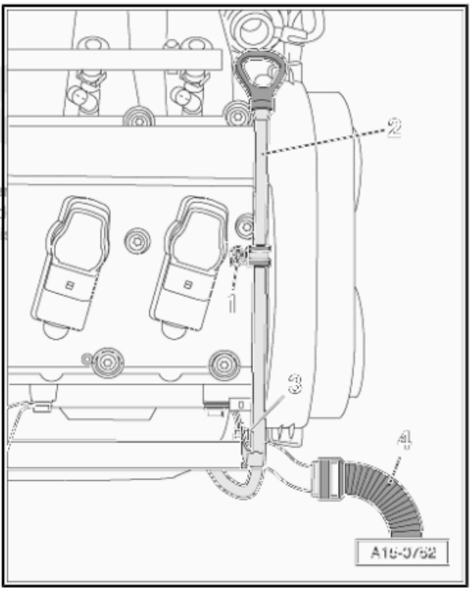
- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



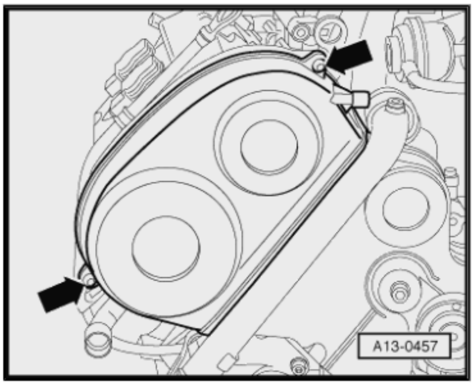
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



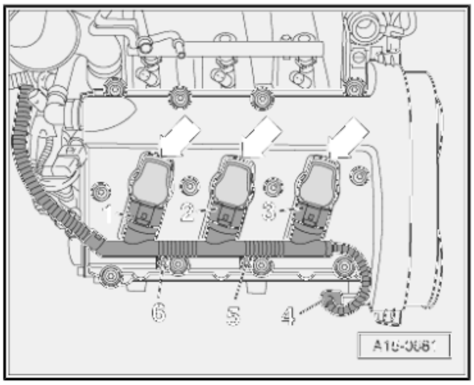
- Unscrew bolts -1- and -3-.
- Disconnect hose -4- at pipe for secondary air.
- Pull guide tube -2- for oil dipstick upwards out of top section of sump and fold forwards.



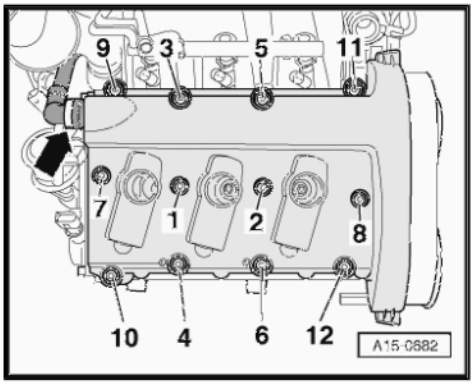
- Unscrew toothed belt guard (front right) from cylinder head cover -arrows-.



- Unscrew bolts -5- and -6-.
- Unplug electrical connectors -1 … 4-.
- Pull out ignition coils -arrows- using puller -T40039- .



- Detach crankcase breather hose -arrow-.
- Unscrew bolts for cylinder head cover (right-side) in the sequence -12 ... 1- and remove cylinder head cover.



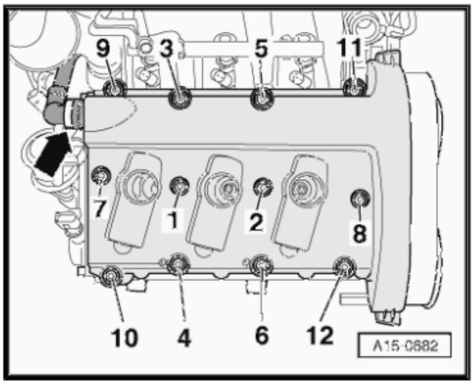
Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Renew self-locking bolts.*
- ♦ *Renew gasket for cylinder head cover if damaged.*

- Tighten bolts for cylinder head cover in the sequence -1 ... 12-.
- Renew O-ring on guide tube for oil dipstick and insert guide tube into hole in top section of sump.
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .



Tightening torques

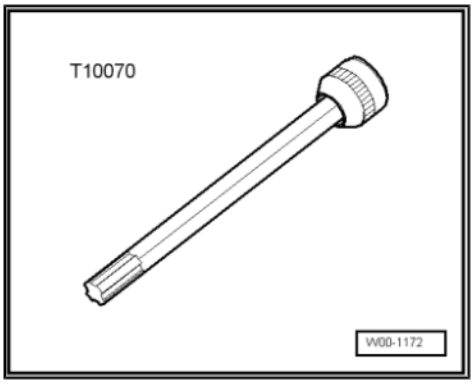
Component	Nm
Cylinder head cover to cylinder head	10
Toothed belt guard (front) to cylinder head cover	6 [13]
Guide tube for dipstick to cylinder head	23

[13] Renew bolts

2.4 Removing cylinder head (left-side)

Special tools and workshop equipment required

- ♦ Special wrench (Polydrive) -T10070-



Procedure

- Engine in vehicle.

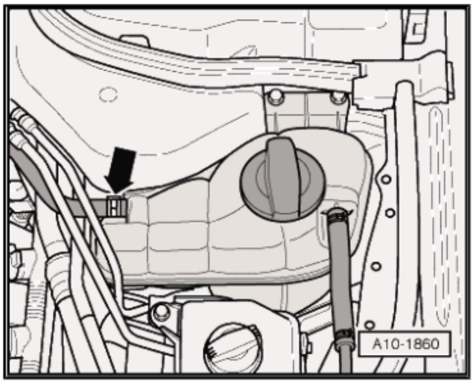
Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

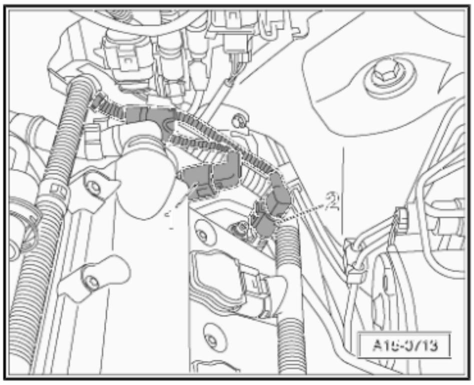
– Remove intake manifold ⇒ page 94 .

– Detach coolant hose -arrow- at expansion tank.



– Unplug electrical connectors -1- and -2- at Hall senders -G163- and -G301- .

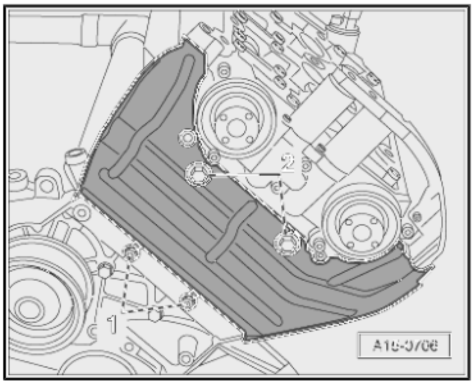
– Unbolt earth wire at rear of cylinder head.



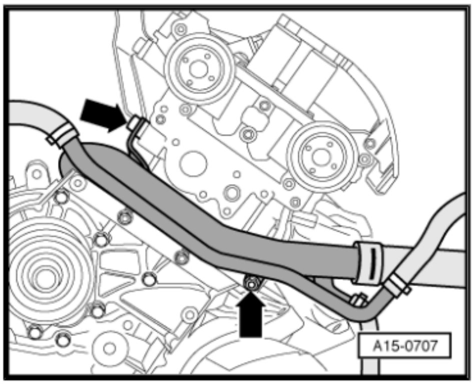
– Remove toothed belt ⇒ page 62 .

– Remove camshaft sprockets on cylinder head (left-side).

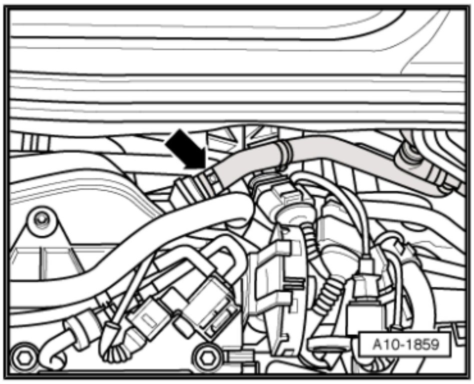
– Unscrew bolts -1- and -2- and remove toothed belt guard (rear left).



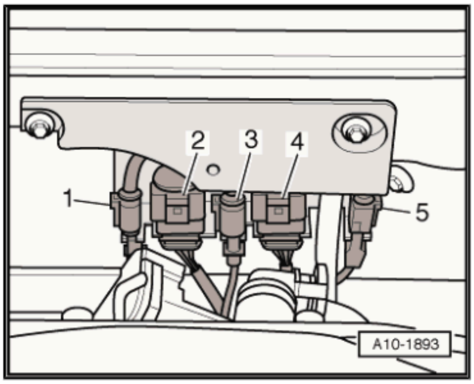
- Unbolt front coolant pipe from cylinder head -arrows-.



- Detach vacuum hose -arrow- going to brake servo at non-return valve.



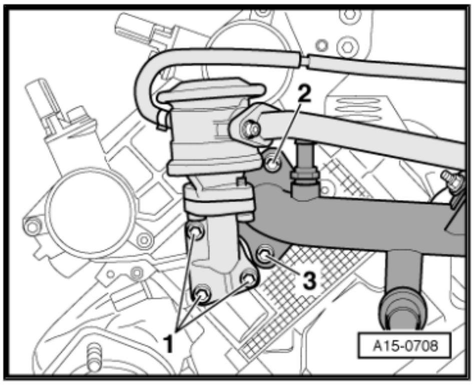
- Unscrew bracket for connectors (rear centre) from bulkhead.
- Remove electrical connectors -1 ... 5- from bracket.



- Unscrew bolts -1- on flange of combination valve for secondary air.
- Detach rear coolant pipe from cylinder head by unscrewing bolts -2- and -3-.

Note

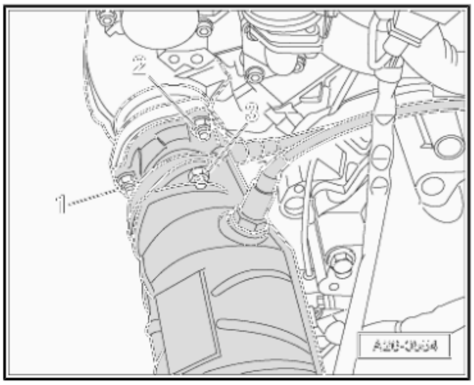
- *The coolant pipe and combination valve do not have to be removed.*
- *Shown from rear with engine removed for illustration purposes.*



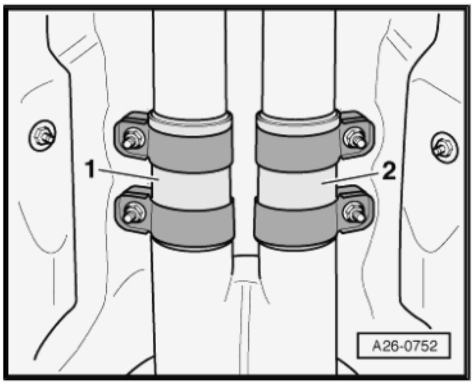
- Unscrew nut -2- (accessible from above) securing front exhaust pipe to exhaust manifold (left-side).

Note

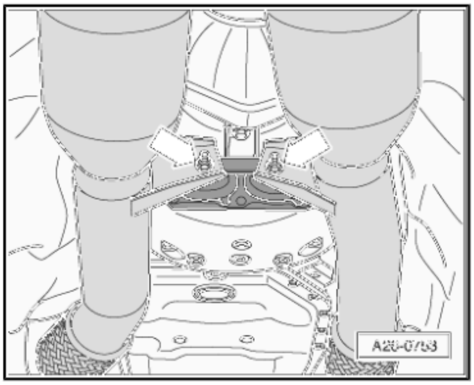
Shown from rear with engine removed for illustration purposes.



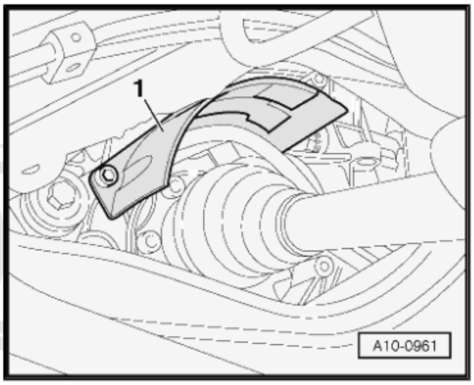
- Loosen the clamp (left-side) -1-.



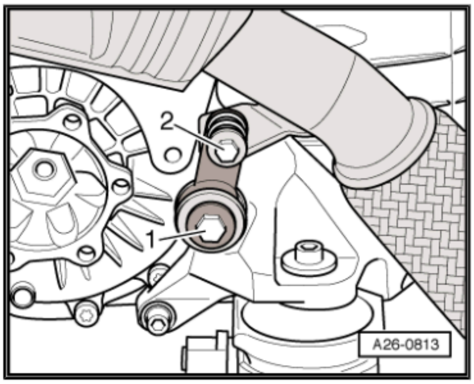
- Unscrew nut -left arrow- at mounting bracket for front exhaust pipe (left-side).



- Unbolt heat shield -1- for drive shaft (left-side) from gearbox.



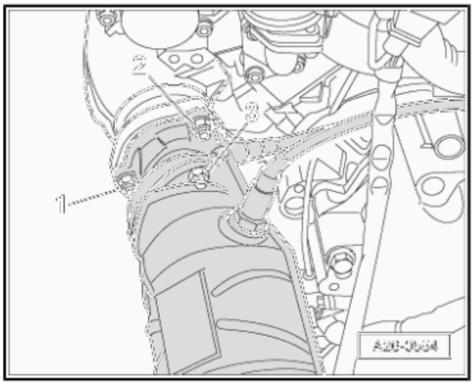
- Remove bolt -1- on bracket (left-side) for exhaust system.



Note

Ignore item marked -2-.

- Remove nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold (left-side).

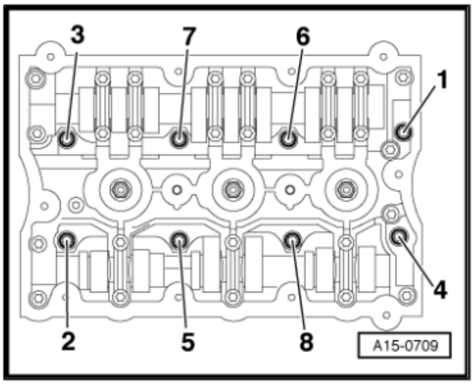


Note

Shown in illustration with engine removed.

- Detach front exhaust pipe from exhaust manifold.

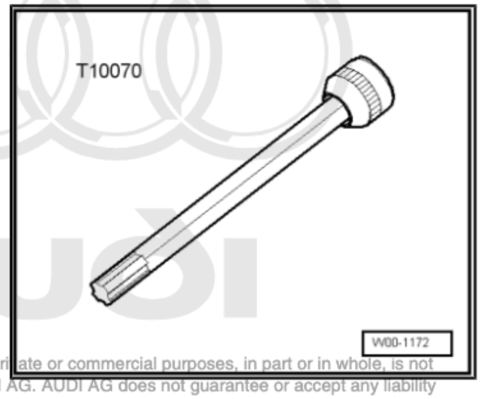
- Loosen cylinder head bolts in the sequence -1 ... 8-.
- Carefully remove the cylinder head.



2.5 Removing cylinder head (right-side)

Special tools and workshop equipment required

- Special wrench (Polydrive) -T10070-



Procedure

- Engine in vehicle.

Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

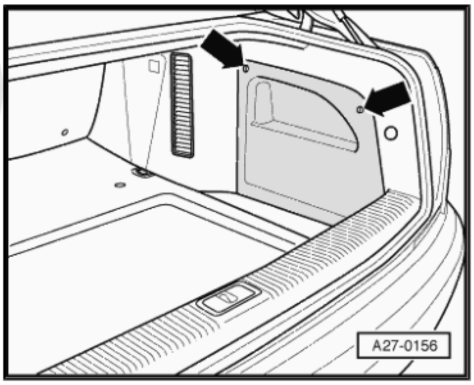
– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

WARNING

Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. Gr. 27 .

– Switch off ignition.

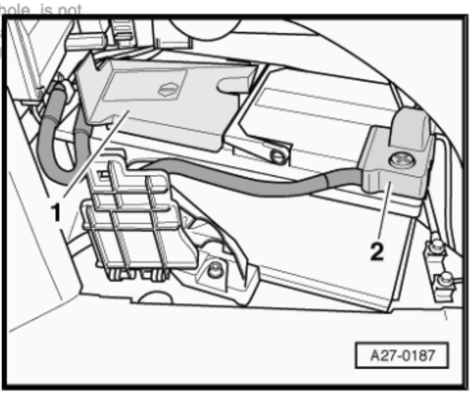
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -1- over battery.

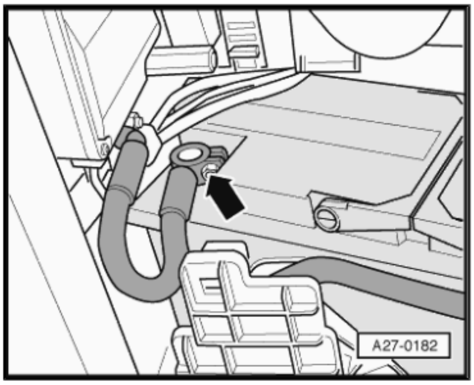
Note

Ignore item marked -2-.



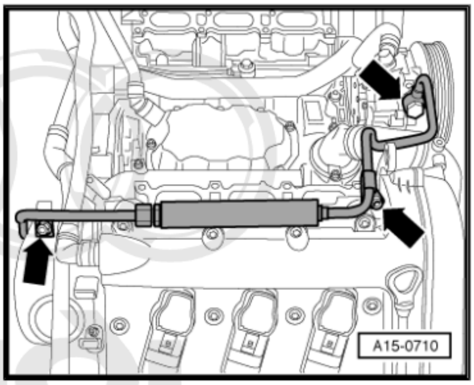
– Disconnect earth cable -arrow- at battery.

– Remove intake manifold ⇒ page 94 .

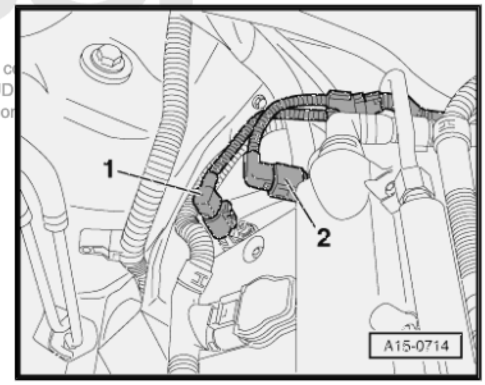


Note

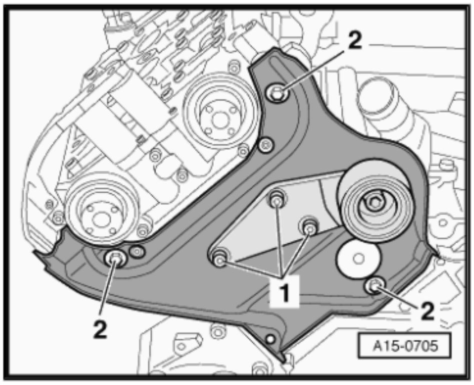
Lay a cloth under the hydraulic pressure pipe to catch any escaping hydraulic fluid.



– Remove pressure pipe for power-assisted steering at vane pump, cylinder head and rear coolant pipe -arrows-.



– Unplug electrical connectors -1- and -2- at Hall senders -G40- and -G300- .

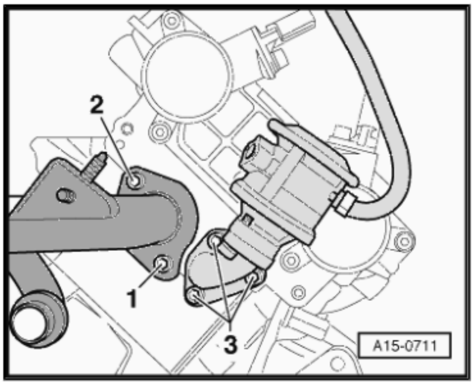


– Remove toothed belt ⇒ page 62 .

– Remove camshaft sprockets on cylinder head (right-side).

– Remove bolts -1- and take off bracket with idler roller.

– Remove bolts -2- and take off toothed belt guard (rear right).



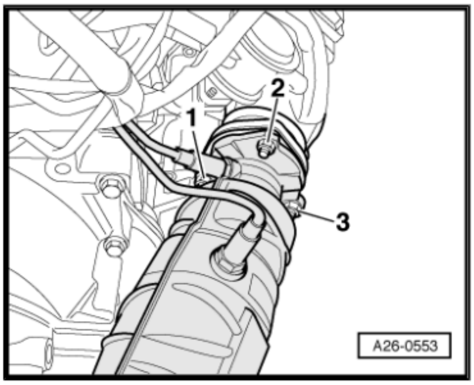
– Unscrew bolts -3- and detach combination valve for secondary air system (together with flange) from cylinder head.

– Unscrew bolts -1- and -2- and detach rear coolant pipe from cylinder head.

Note

- *The coolant pipe remains installed.*
- *Shown from rear with engine removed for illustration purposes.*

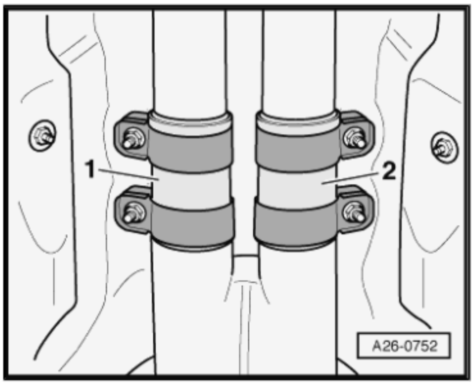
- Unscrew nut -2- (accessible from above) securing front exhaust pipe to exhaust manifold (right-side).



Note

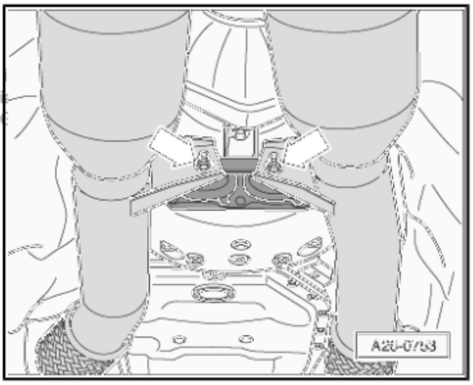
Shown from rear with engine removed for illustration purposes.

- Loosen the clamp (right-side) -2-.

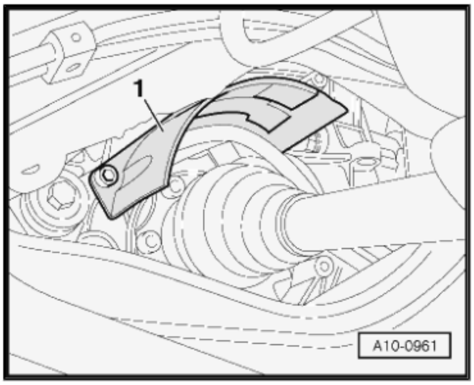


Audi

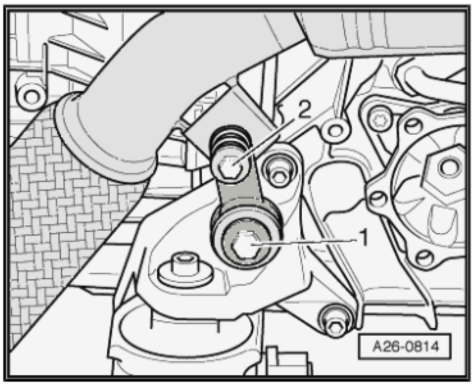
- Unscrew nut -right arrow- at mounting bracket for front exhaust pipe (right-side).



- Unbolt heat shield -1- for drive shaft (right-side) from gearbox.



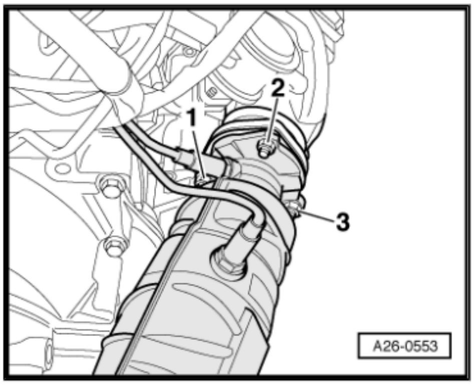
- Remove bolt -1- on bracket (right-side) for exhaust system.



Note

Ignore item marked -2-.

- Remove nuts -1- and -3- (accessible from below) securing front exhaust pipe to exhaust manifold (right-side).

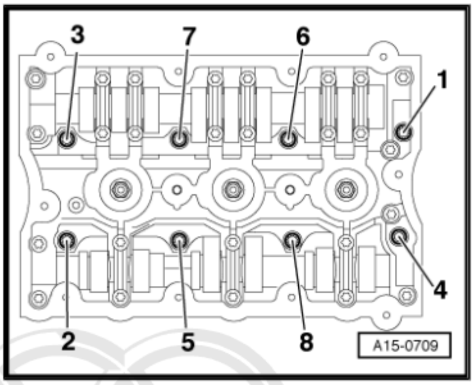


Note

Illustration shows engine removed.

- Detach front exhaust pipe from exhaust manifold.

- Loosen cylinder head bolts in the sequence -1 ... 8-.
- Carefully remove the cylinder head.



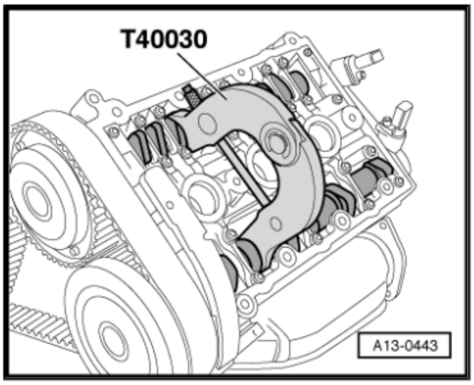
2.6 Installing cylinder head

Note

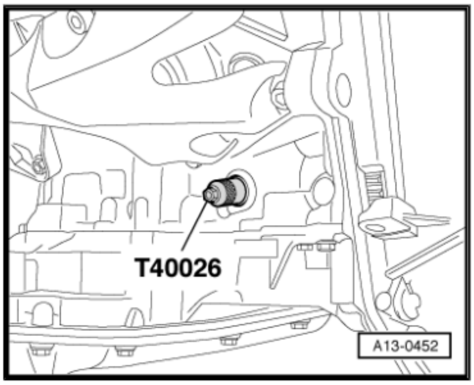
- *Renew the cylinder head bolts.*
- *Renew self-locking nuts and bolts when performing assembly work.*
- *Renew bolts which are tightened to a specified angle as well as oil seals and gaskets.*
- *If repairing, carefully remove any remaining gasket material from the cylinder head and cylinder block. Ensure that no long scores or scratches are made on the surfaces.*
- *Carefully remove any remaining emery and abrasive material.*
- *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Do not remove new cylinder head gasket from packaging until it is ready to be fitted.*
- *Handle gasket very carefully. Damage to the silicone coating or the indented area will lead to leaks.*
- *Position cylinder head gasket on dowel sleeves. The word “oben” (top) or the Part No. should face towards cylinder head.*
- *Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.*
- *When renewing a cylinder head, a sealing cap must be driven into the front of the cylinder head ⇒ page 74 .*
- *When installing an exchange cylinder head with the camshafts fitted, the contact surfaces between bucket tappet and cam running surface must be oiled after installation of the cylinder head.*
- *The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

– Before installing cylinder head, set crankshaft and camshafts to “TDC”:

• The camshaft clamp -T40030- must be attached to both cylinder heads.



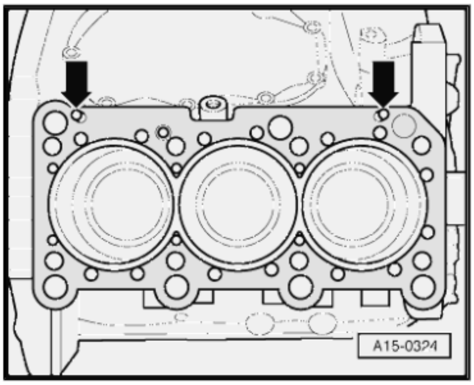
- The locking pin -T40026- must be screwed into the crankshaft.



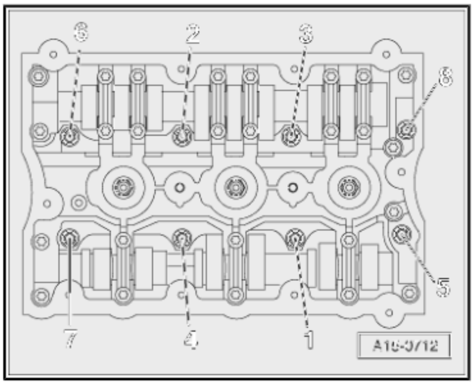
– Fit new cylinder head gasket.

- Note position of centering pins -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word “oben” (top) or the Part No. should face towards the cylinder head.

– Fit the cylinder head.



- Insert new cylinder head bolts and tighten finger-tight.
- Insert new cylinder head bolts and tighten hand-tight.
- Tighten cylinder head in 3 stages in the following sequence:



Stage	Tightening
I	– Tighten with torque wrench to 40 Nm.
II	– Turn 90° ($^1/_4$ turn) further using a rigid wrench.
III	– Turn 90° ($^1/_4$ turn) further using a rigid wrench.

Note

It is not necessary to retighten cylinder head bolts.

- Install toothed belt (adjust valve timing) ⇒ page 69 .

Note

After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.

- Install front exhaust pipe together with catalytic converter: left-side ⇒ page 199 , right-side ⇒ page 205 .
- Align exhaust system free of stress ⇒ page 215 .
- Screw in centering pin for intake manifold.
- Install intake manifold ⇒ page 94 .
- Connect battery. Procedures required ⇒ Electrical system; Rep. Gr. 27 .
- Fill cooling system with fresh coolant ⇒ page 165 .
- Top up power steering fluid and bleed steering system: ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48

Tightening torques

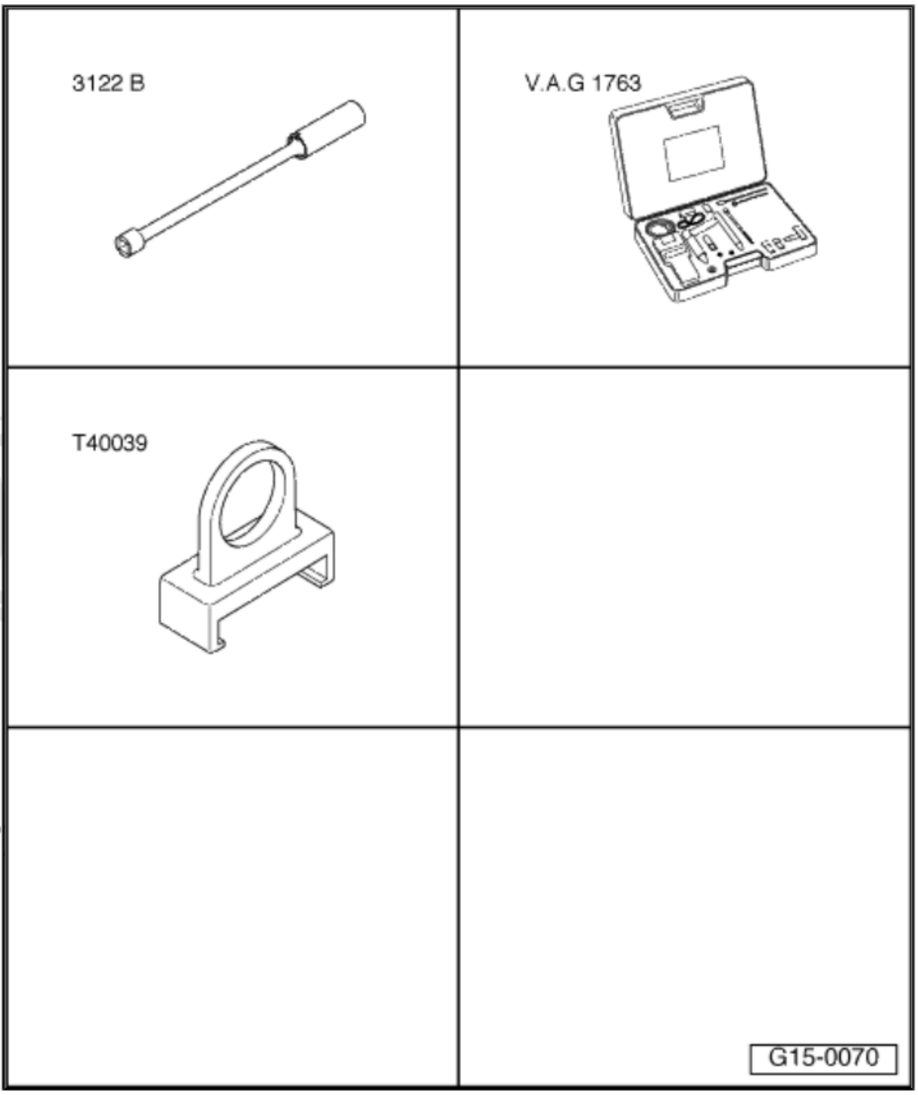
Component		Nm
Coolant pipe (rear) to cylinder head		10
Combination valve to cylinder head		10
Toothed belt guard (rear) to cylinder head/ cylinder block		10 [14)]
Bracket for idler roller to cylinder head		10 [14)]
Coolant pipe (front)	M 6	10
to cylinder head	M 8	23
Pressure pipe for power-assisted steering to hydraulic pump		47
Pressure pipe for power-assisted steering to cylinder head		10
Pressure pipe for power-assisted steering to coolant pipe (rear)		20

14) Renew bolts.

2.7 Checking compression

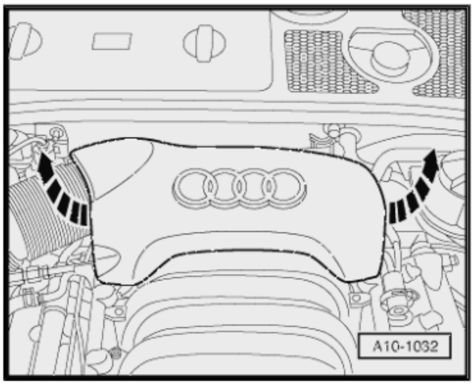
Special tools and workshop equipment required

- ♦ Spark plug socket -3122 B-
- ♦ Compression tester -V.A.G 1763-
- ♦ Puller -T40039-

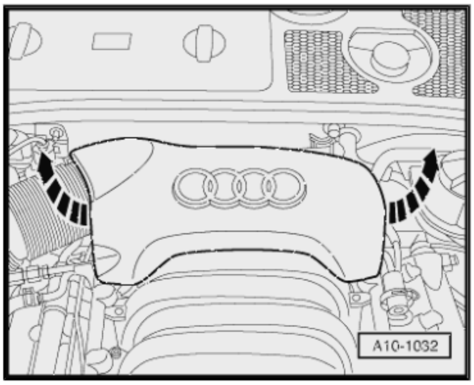


Procedure

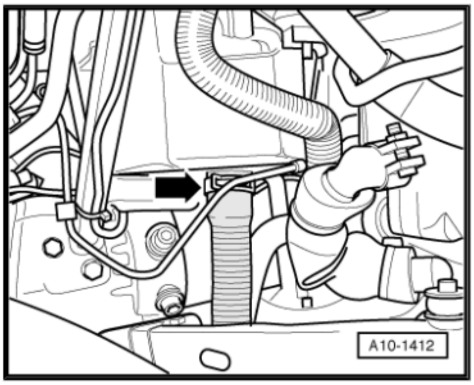
- Engine oil temperature at least 30 °C.
- Battery voltage at least 12.5 V.



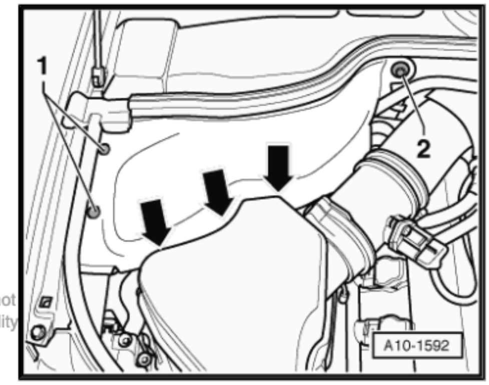
- Pull off rear engine cover -arrows-.



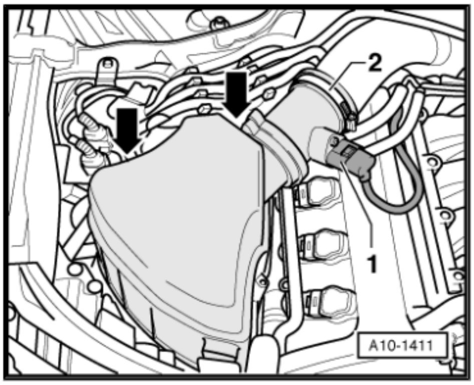
- Detach wheel housing liner (front right) at the front.
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



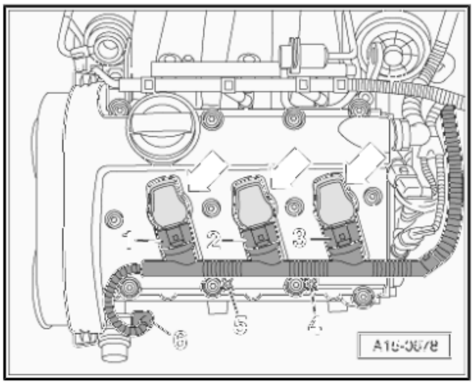
- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



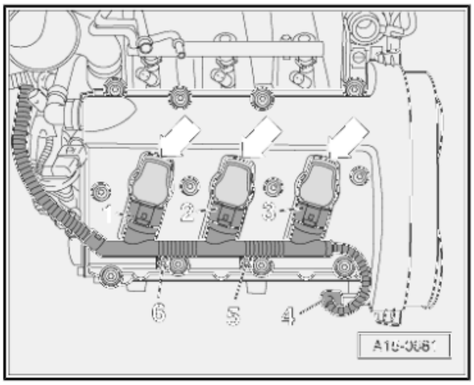
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



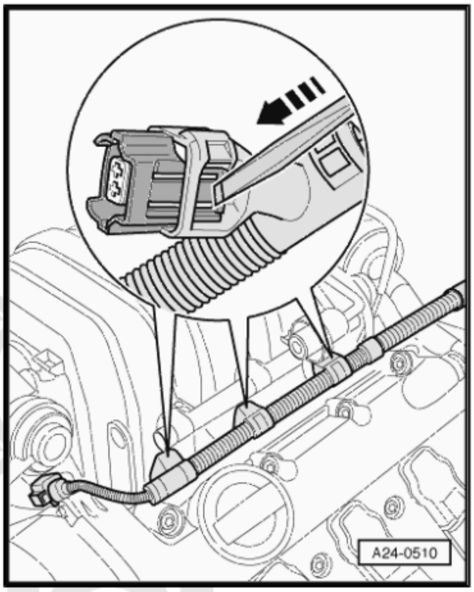
- Unscrew bolts -4- and -5- at cylinder head (left-side).
- Unplug electrical connectors -1 ... 3- and -6-.
- Pull out ignition coils -arrows-.



- Unscrew bolts -5- and -6- at cylinder head (right-side).
- Unplug electrical connectors -1 … 4-.
- Pull out ignition coils -arrows- using puller -T40039- .
- Remove spark plugs with spark plug spanner -3122 B- .



- Unplug all electrical connectors at all injectors; to do so, release connectors on underside -arrow-.
- Test the compression pressure with the compression tester -V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

- Have a 2nd mechanic press down the accelerator pedal completely and simultaneously operate the starter until the pressure no longer increases on the tester display.

Compression pressure:

New	Wear limit	Difference between cylinders
pressure in bar	pressure in bar	pressure in bar
10.0 … 14.0	9.0	max. 3.0

Assembly is carried out in the reverse order; note the following:

- Install spark plugs ⇒ Maintenance ; Booklet 402 .
- Interrogate and erase the fault memory for engine control unit, as faults are stored when the electrical connectors are unplugged.

For this purpose, use vehicle diagnostic, testing and information system -VAS 5051 A- .

3 Intake manifold

3.1 Intake manifold - exploded view of components

1 - Intake manifold
  - ☐ Removing and installing ⇒ page 94

2 - Resonator

3 - 10 Nm

4 - O-rings

5 - Fuel return pipe

6 - Fuel supply pipe
  - ☐ Tighten union nut to 25 Nm.

7 - Bush

8 - 10 Nm

9 - Retaining plate for solenoid valves

10 - Fuel rail

11 - Air duct

12 - 10 Nm

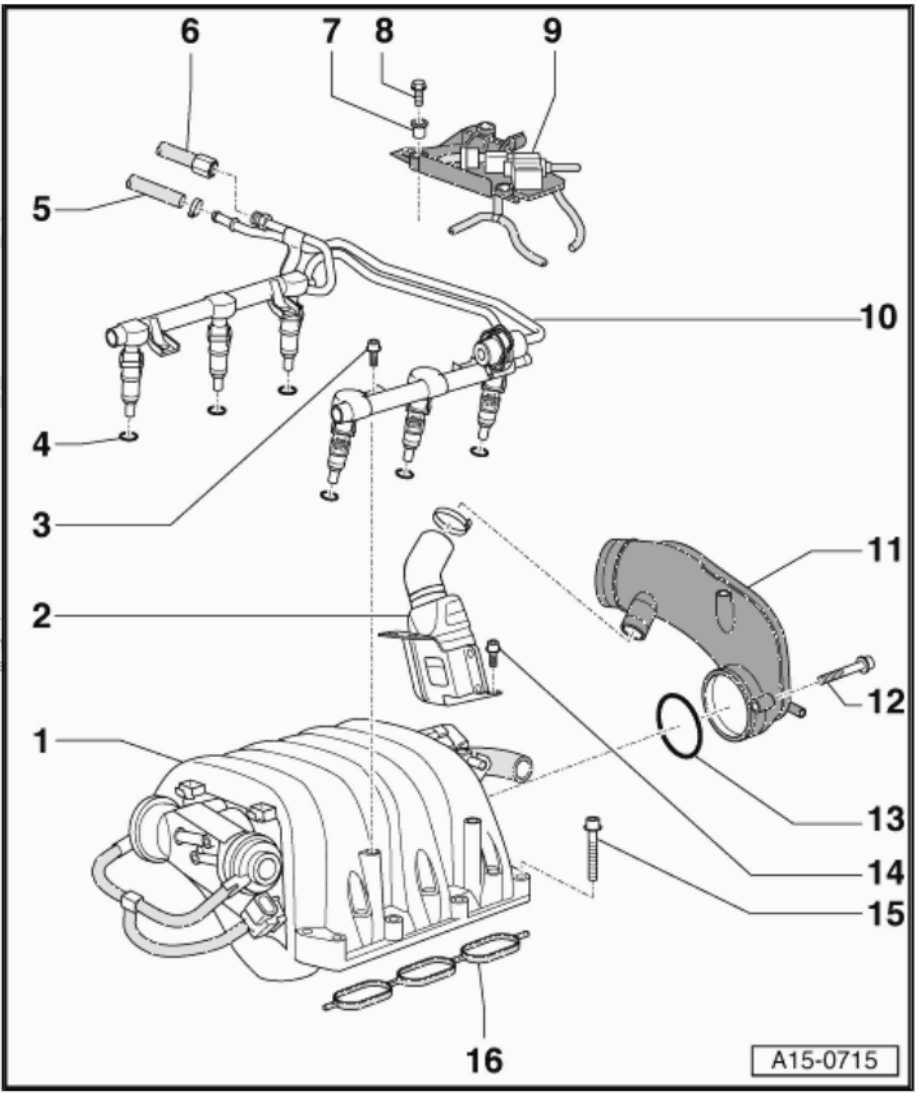
13 - O-ring
  - ☐ Renew

14 - 10 Nm

15 - 10 Nm
  - ☐ Tighten in stages and in diagonal sequence

16 - Intake manifold gasket
  - ☐ Renew

Protected by
permitted u
with respe



3.2 Removing and installing intake manifold

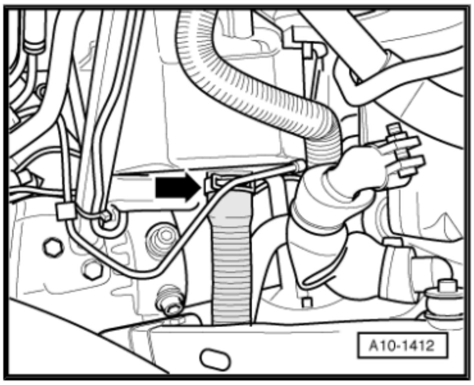
Removing

Note

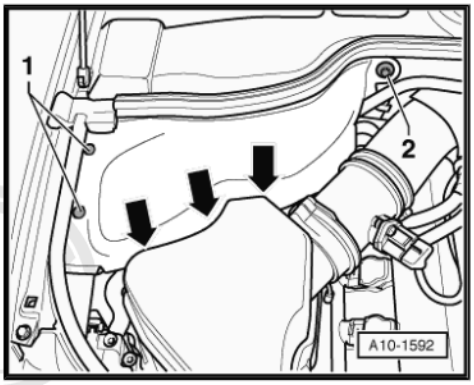
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Drain off coolant ⇒ page 163 .

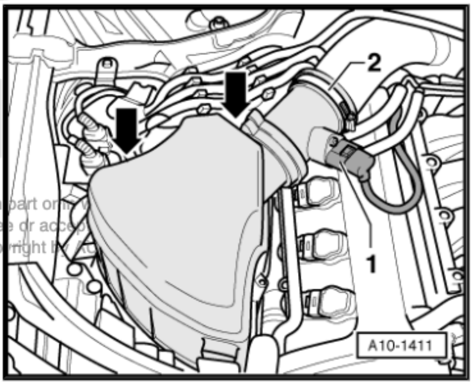
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



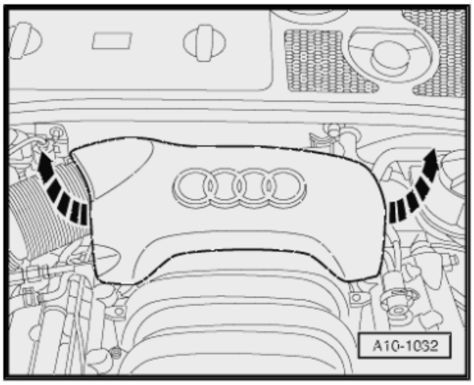
- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



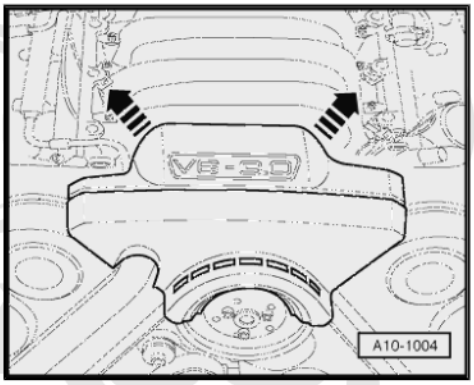
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



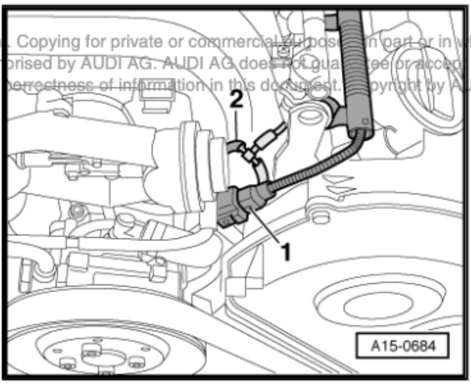
- Pull off rear engine cover -arrows- ...



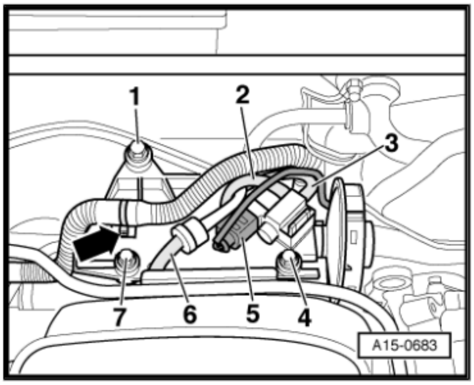
- ... as well as front engine cover -arrows-.



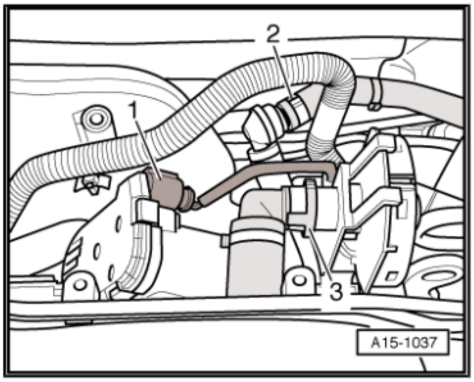
- Detach electrical connector -1-.
- Detach vacuum hose -2- from T piece.



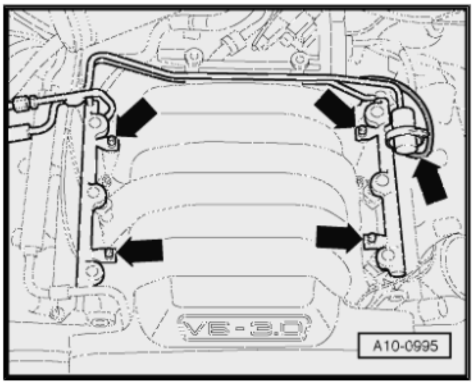
- Detach vacuum hoses -2- and -3- at intake manifold change-over valve -N156- .
- Detach vacuum hose -6- from non-return valve.
- Detach electrical connector -5-.
- Move the crankcase breather hose -arrow- clear.
- Unscrew and remove bolts -1-, -4- and -7- on retaining plate for solenoid valves.
- Detach retaining plate for solenoid valves from intake manifold.
- On underside of retaining plate, pull vacuum hose off T piece.



- Detach electrical connector -1- at throttle valve module -J338- .
- Disconnect vacuum hoses -2- and -3-.



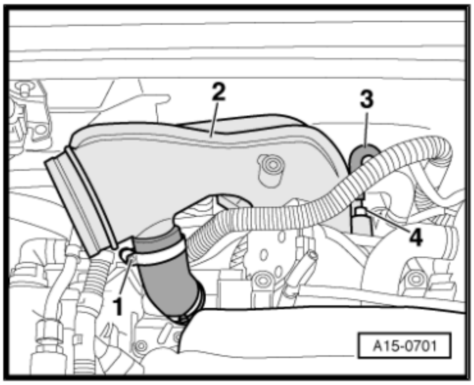
- Unplug electrical connectors at all injectors.
- Detach vacuum hose at fuel pressure regulator and unscrew securing bolts on fuel rail -arrows-.
- Pull fuel rail together with injectors off intake manifold (pull off evenly from the top) and place it on a clean cloth in the engine compartment.



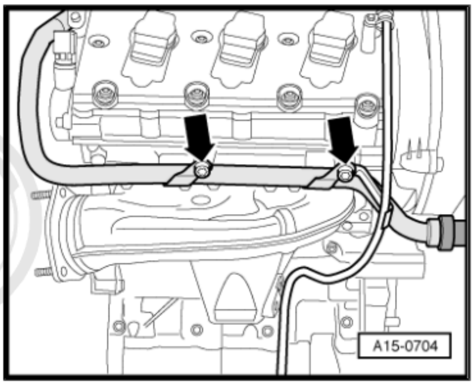
Note

Make sure the removed injectors do not become soiled.

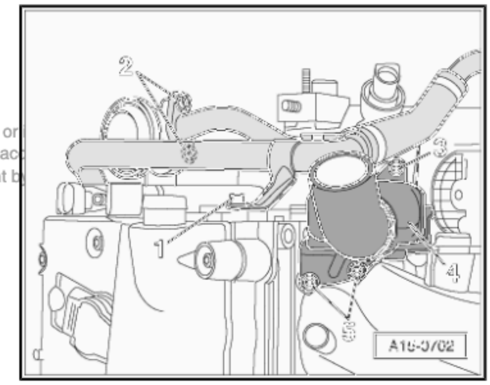
- Pull hose -1- off air duct.
- Unscrew bolt -4- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull vacuum hose -3- off at lower part of air duct.



- On right side of engine, unscrew and remove bolts -arrows- at secondary air pipe.

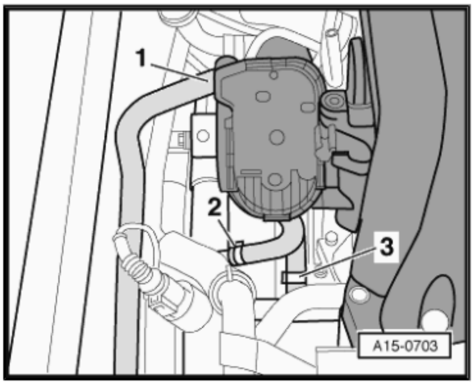


- Unscrew bolts -1- and -2- at secondary air pipes.
- Unscrew bolts -3- and -5- and remove resonator -4-.

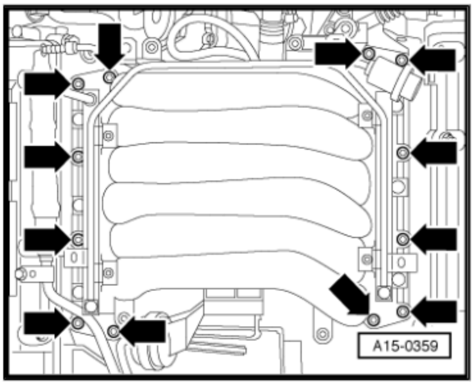


– Detach vacuum hose -1- leading to solenoid valve 1 for activated charcoal filter system -N80- .

– Detach coolant hoses -2- and -3-.



– Unscrew and remove intake manifold -arrows-.



Note

Seal intake ports on cylinder heads with clean cloths.

Installing

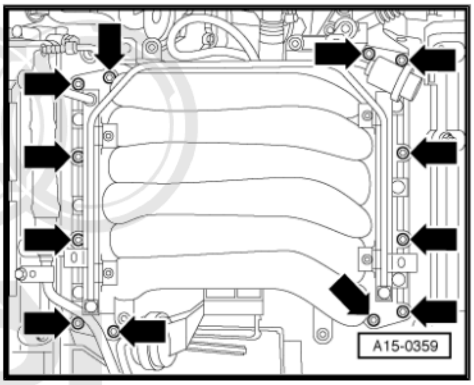
Installation is carried out in the reverse order; note the following:

Note

- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Always renew seals and gaskets.*
- *See the notes regarding installation of the fuel rail ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24 .*

– Tighten bolts on intake manifold in stages and in diagonal sequence -arrows-.

– Fill cooling system ⇒ page 165 .



Tightening torques

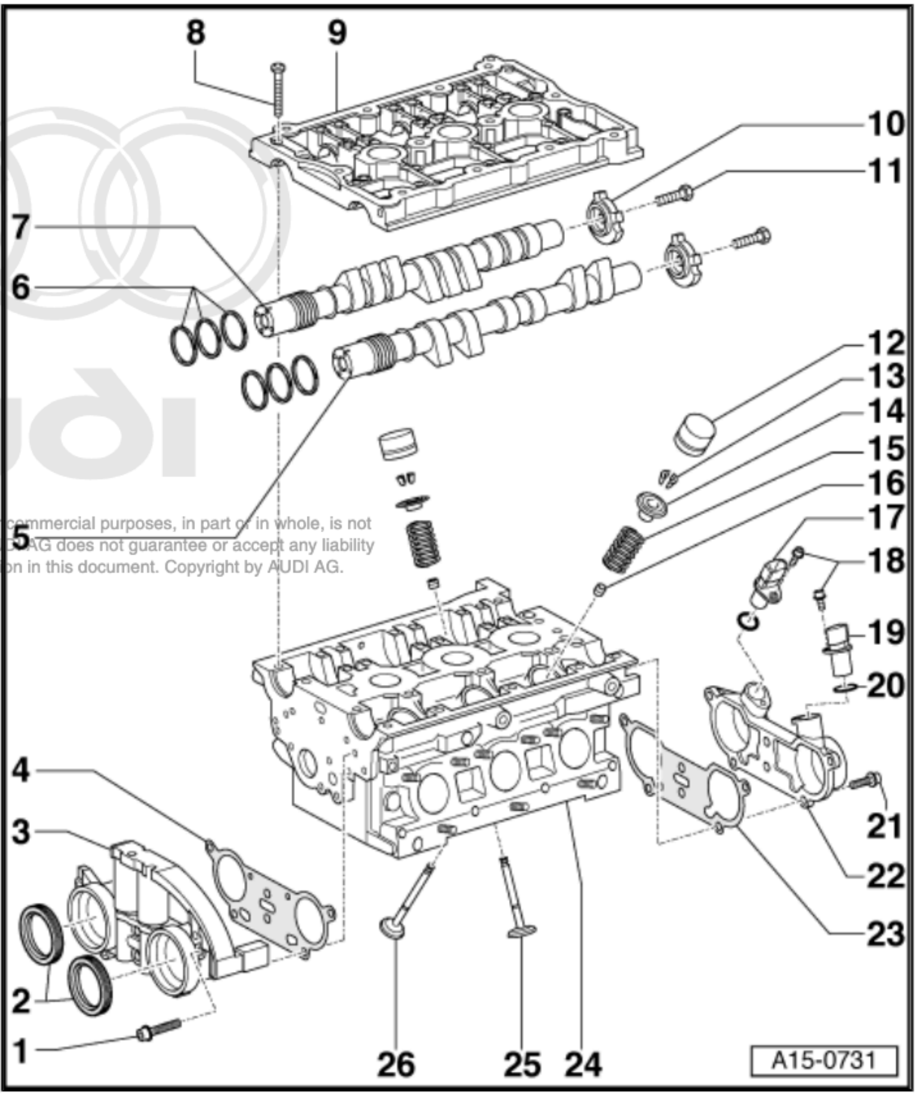
Component		Nm
Intake manifold to cylinder head		10
Resonator to coolant pipe / to cylinder head		10
Secondary air pipe	M 6	10
to cylinder head	M 8	23
Secondary air pipe to combination valve for secondary air		10
Air duct to intake manifold		10
Retaining plate for solenoid valves to intake manifold / air duct		10

4 Servicing valve gear

Note

- *Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.*
- *Engine is not to be started for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*
- *The following illustration shows the left-side cylinder head.*

4.1 Valve gear - exploded view of components



1 - 10 Nm

2 - Oil seals

- ☐ Renew ⇒ page 103

3 - Housing for solenoid valves for camshaft adjustment

4 - Gasket

- ☐ Renew

5 - Exhaust camshaft

- ☐ Checking axial clearance ⇒ page 103
- ☐ Removing and installing ⇒ page 105
- ☐ Check radial clearance with Plastigage (bucket tappet removed)
- ☐ Radial clearance: wear limit: 0.1 mm
- ☐ Runout: max. 0.01 mm

6 - Piston rings

- ☐ For camshaft adjuster
- ☐ Hook ends of piston rings together ⇒ page 101

7 - Inlet camshaft

- ☐ Checking axial clearance ⇒ page 103
- ☐ Removing and installing ⇒ page 105
- ☐ Check radial clearance with Plastigage (bucket tappet removed)
- ☐ Radial clearance: wear limit: 0.1 mm
- ☐ Runout: max. 0.01 mm

8 - 10 Nm

- ☐ Tighten in several stages, working from inside to outside

9 - Ladder frame

- ☐ With integrated camshaft bearings
- ☐ Removing and installing: see Removing and installing camshafts and camshaft adjusters ⇒ page 105

10 - Rotor for Hall sender

- ☐ Note installation position (notch on camshaft)

11 - 23 Nm

12 - Hydraulic bucket tappets

- ☐ Checking ⇒ page 113
- ☐ Removing and installing: see Removing and installing camshafts and camshaft adjusters ⇒ page 105
- ☐ Do not interchange (mark allocation)
- ☐ Place down with contact surface facing downwards
- ☐ Check axial clearance of camshaft before installing ⇒ page 103
- ☐ Lubricate contact surface

13 - Valve cotters

14 - Valve springs

15 - Valve spring plate

16 - Valve stem oil seal

- ☐ Renewing with cylinder head installed ⇒ page 115
- ☐ Renewing with cylinder head removed ⇒ page 119

17 - Hall sender for inlet camshaft

- ☐ Cylinder bank 1 (right-side) Hall sender -G40-
- ☐ Cylinder bank 2 (left-side) Hall sender 2 -G163-

18 - 10 Nm

19 - Hall sender for exhaust camshaft

- ☐ Cylinder bank 1 (right-side) Hall sender 3 -G300-
- ☐ Cylinder bank 2 (left-side) Hall sender 4 -G301-

20 - O-ring

- ☐ Renew

21 - 10 Nm

22 - Hall sender housing

23 - Gasket

- ☐ Renew

24 - Cylinder head

- ☐ See note ⇒ page 99
- ☐ Checking valve guides, grinding-in valve seats ⇒ page 122
- ☐ Machining valve seats ⇒ page 123

25 - Inlet valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation
- ☐ Valve dimensions ⇒ page 101
- ☐ Checking valve guides, grinding-in valve seats ⇒ page 122

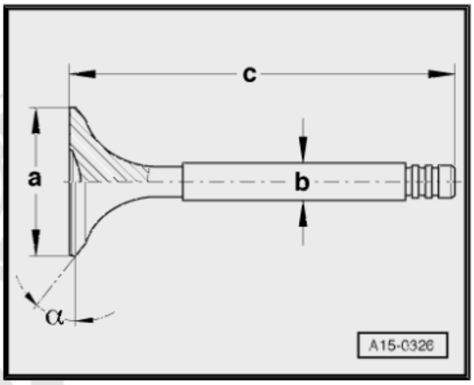
26 - Exhaust valve

- ☐ Do not machine, only grinding-in is permitted
- ☐ Mark installation position for re-installation

☐ Valve dimensions ⇒ page 101

☐ Checking valve guides, grinding-in valve seats ⇒ page 122

Valve dimensions



Note

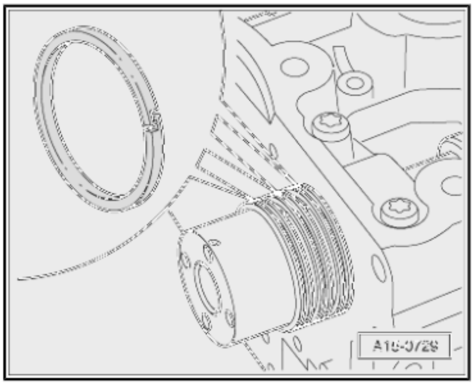
Valves are not to be machined. Only grinding-in is permitted.

Dimension		Inlet valve	Exhaust valve
∅ a	mm	26.80 … 27.00	29.80 … 30.00
∅ b	mm	5.96 … 5.97	5.94 … 5.95
c	mm	104.84 … 105.34	103.64 … 104.14
α	∠°	45	45

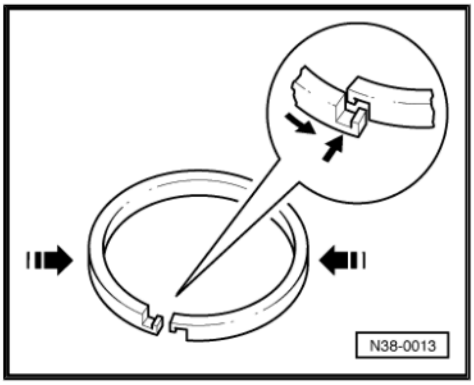
WARNING

- *Care must be taken when disposing of old sodium-filled exhaust valves.*
- *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water. After preparing the valves, throw a maximum of ten into a bucket of water. Then step away immediately, since a chemical reaction will occur in which the sodium filling burns.*
- *After performing these procedures the valves can be disposed of in the normal way.*

Hooking together ends of piston rings

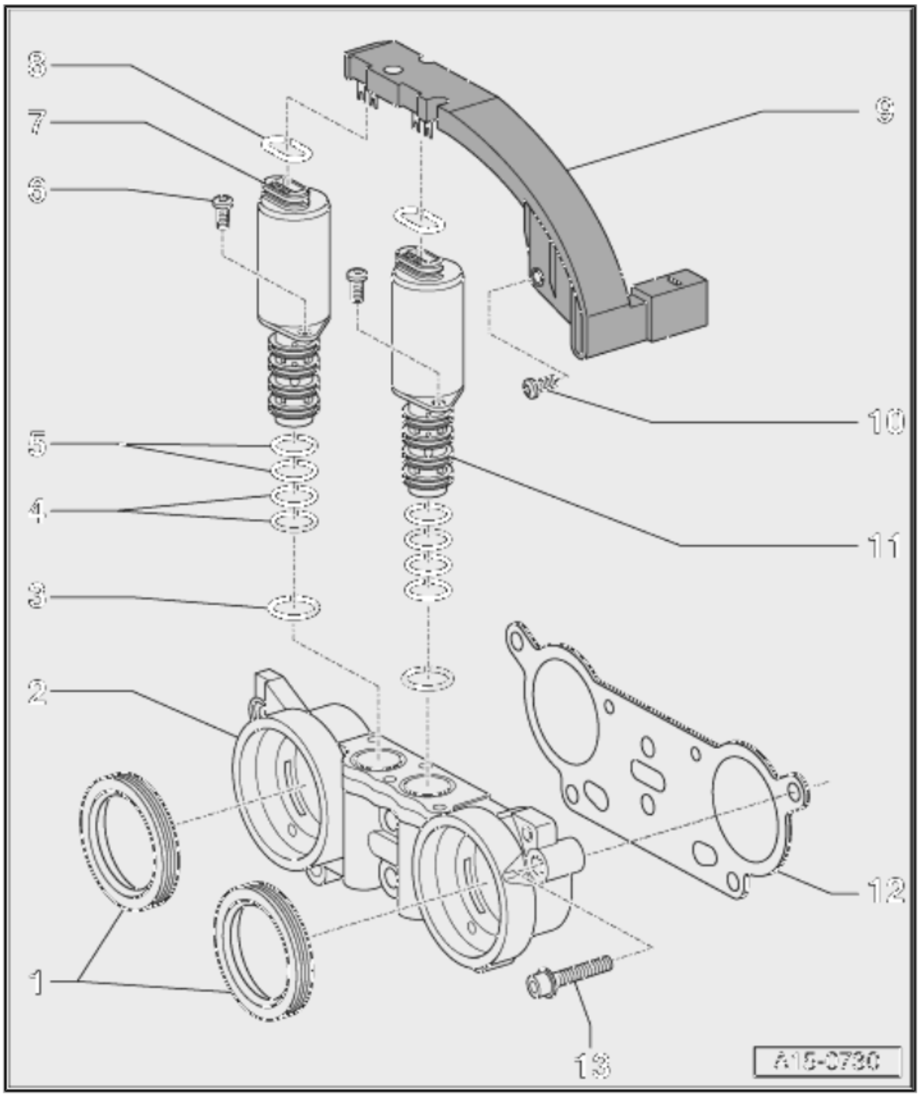


– Check that piston rings are installed on camshafts and that ends of piston rings are hooked together.



– If necessary, hook ends of piston rings -arrows- together as illustrated.

4.2 Camshaft adjustment - exploded view of components



1 - Oil seals
- ☐ Renew ⇒ page 103

2 - Housing for solenoid valves for camshaft adjustment

3 - O-rings
- ☐ Green
- ☐ Between solenoid valves and solenoid valve housing
- ☐ Renew

4 - O-rings
- ☐ Black
- ☐ Renew

5 - O-rings
- ☐ Green
- ☐ Renew

6 - 4 Nm

7 - Camshaft control valve - inlet side
- ☐ Cylinder bank 1 (right-side) - camshaft control valve -N205-
- ☐ Cylinder bank 2 (left-side) - camshaft control valve 2 -N208-
- ☐ Do not install camshaft control valve for exhaust side on inlet side
- ☐ Note identification marking: “12. 100 338”
- ☐ Checking ⇒ page 129

8 - Seal
- ☐ Renew if damaged

9 - Connector adapter
- ☐ Adapter must be renewed if it has been disconnected from camshaft control valves
- ☐ Push carefully onto connectors on camshaft control valves until it engages

10 - 4 Nm

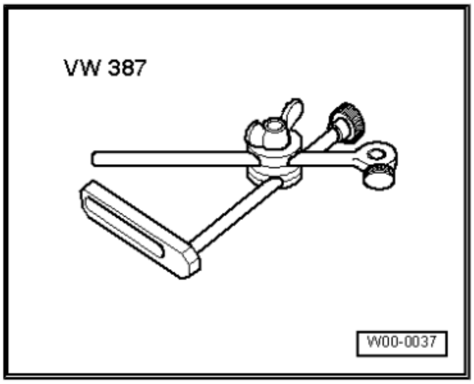
11 - Camshaft control valve - exhaust side
- ☐ Cylinder bank 1 (right-side) - camshaft control valve 1, exhaust -N318-
- ☐ Cylinder bank 2 (left-side) - camshaft control valve 2, exhaust -N319-
- ☐ Do not install camshaft control valve for inlet side on exhaust side
- ☐ Note identification marking: “12. 100 339”
- ☐ Checking ⇒ page 129

12 - Gasket
- ☐ Renew

13 - 10 Nm

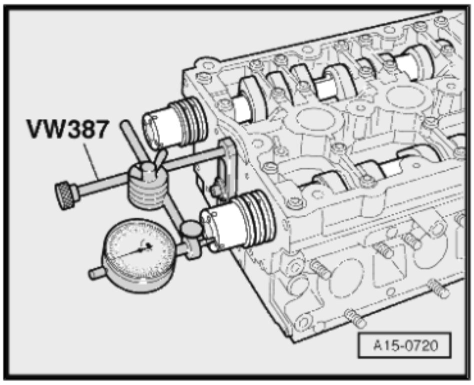
4.3 Checking axial clearance of camshafts

Special tools and workshop equipment required



- ◆ Universal dial gauge bracket -VW 387-
- ◆ Dial gauge

Test sequence

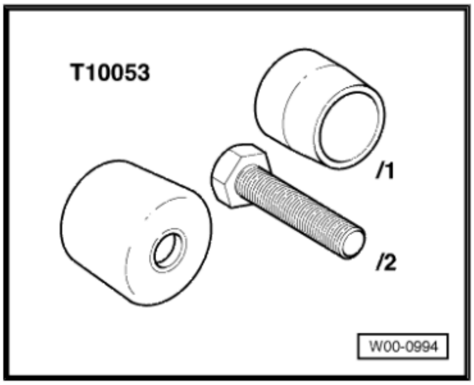


- – Remove the camshafts ⇒ page 105 .
- – Remove bucket tappets.
- – Fit camshafts in cylinder head and install ladder frame.
- – Attach dial gauge bracket -VW 387- with dial gauge to cylinder head.
- – Press the camshaft that is to be checked against the dial gauge by hand.
- – Set dial gauge to “0”.
- – Press crankshaft away from dial gauge and read off value:
- • Radial clearance (new): 0.08 … 0.16 mm
- • Radial clearance (wear limit): 0.20 mm.

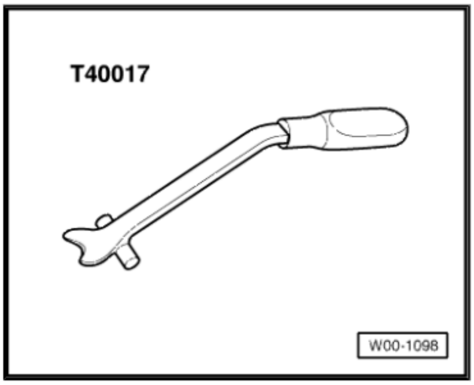
4.4 Renewing camshaft oil seals

Special tools and workshop equipment required

- ◆ Assembly tool -T10053-



- Lever -T40017-



Removing

Note

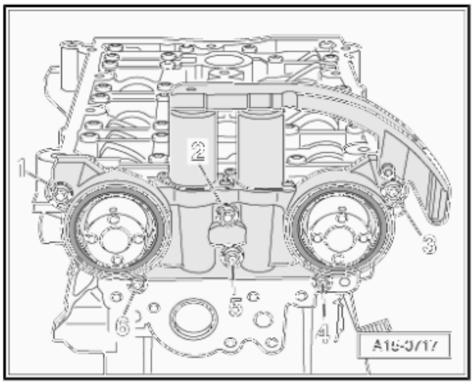
If one of the oil seals is leaking, renew seals on both cylinder heads.

– Remove toothed belt ⇒ page 62 .

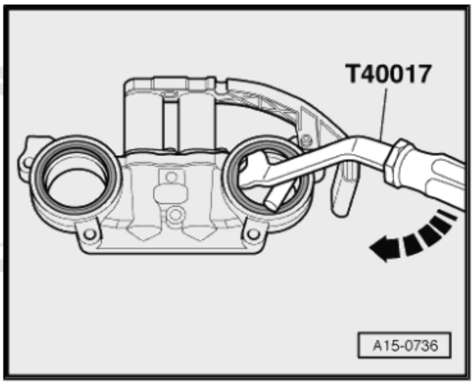
– Mark positions of camshaft sprockets for re-installation.

– Remove camshaft sprockets.

– Unscrew bolts -1 ... 6- and remove housing for camshaft control valves.



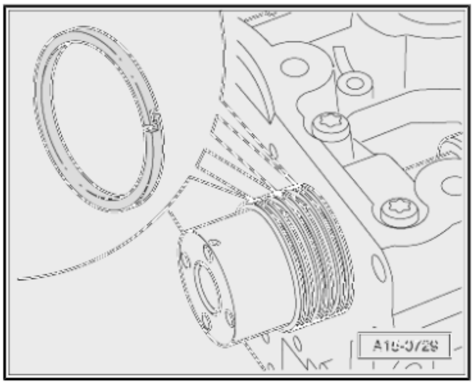
– Remove oil seals for camshafts using lever -T40017- .



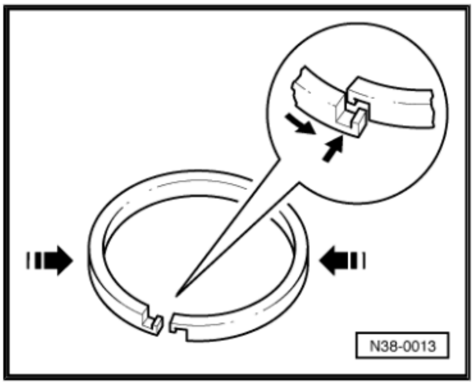
Installing

Note

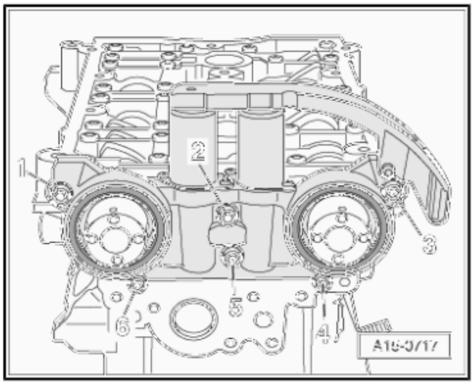
Renew seals.



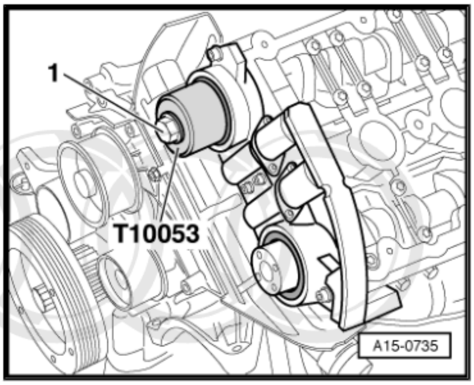
- Before installing housing for camshaft control valves, check that piston rings are installed on camshafts and that ends of piston rings are hooked together.



- If necessary, hook ends of piston rings -arrows- together as illustrated.



- Install housing for camshaft control valves and tighten bolts -1 ... 6-.



- Using the assembly tool -T10053- and bolt -1-, press the new oil seals for camshafts in until they are flush with the housing.

Perform further installation in reverse order, paying attention to the following:

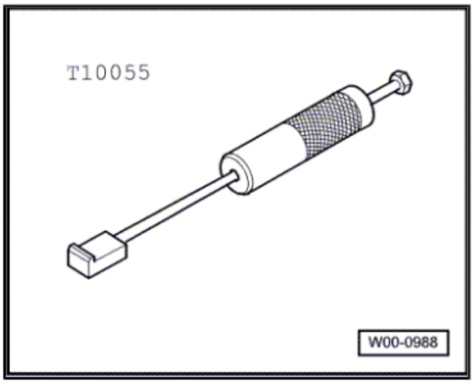
- Install toothed belt (adjust valve timing) ⇒ page 69 .

4.5 Removing and installing camshafts and camshaft adjuster

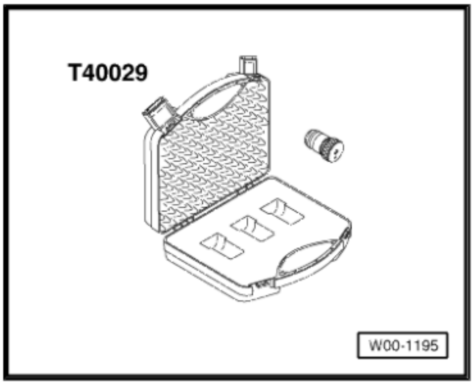
Special tools and workshop equipment required

Audi

- Puller -T10055-



- Mandrel -T40029-



- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Parts catalogue

Removing

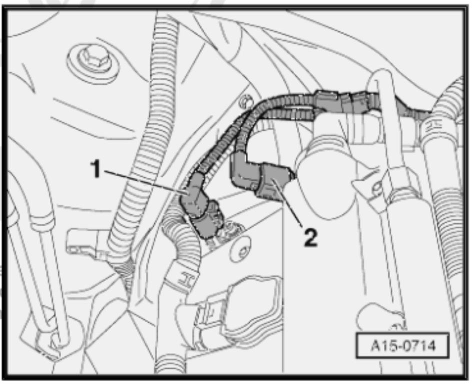
– Remove toothed belt ⇒ page 62 .

– Remove camshaft sprockets on respective cylinder head.

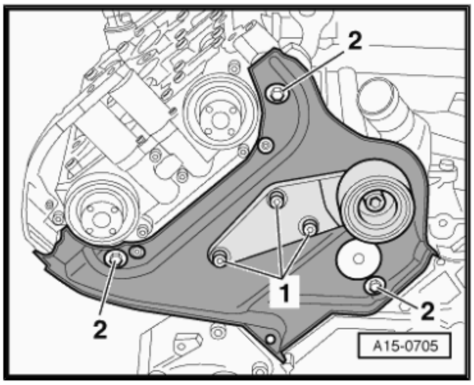
– Remove combination valve for secondary air system: left-side ⇒ page 235 , right-side ⇒ page 236 .

Cylinder head (right-side):

– Unplug electrical connectors -1- and -2- at Hall senders -G40- and -G300- .

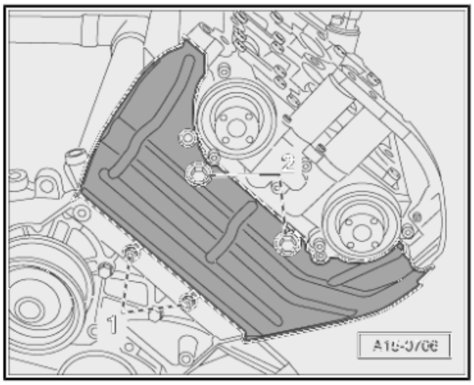


- Remove bolts -1- and take off bracket with idler roller.
- Remove bolts -2- and take off toothed belt guard (rear right).



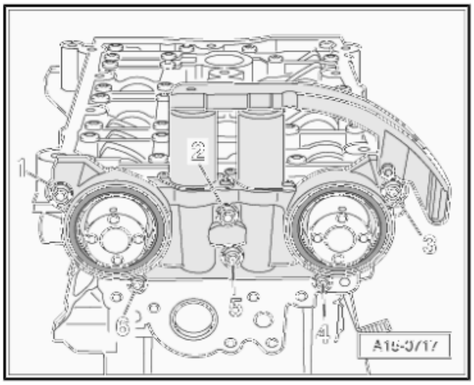
Cylinder head (left-side):

- Remove bolts -1- and -2- and take off toothed belt guard (rear left).

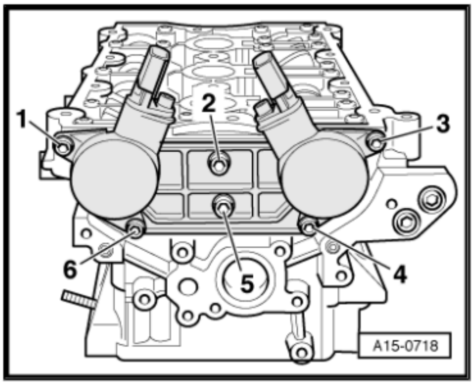


Continuation for both sides:

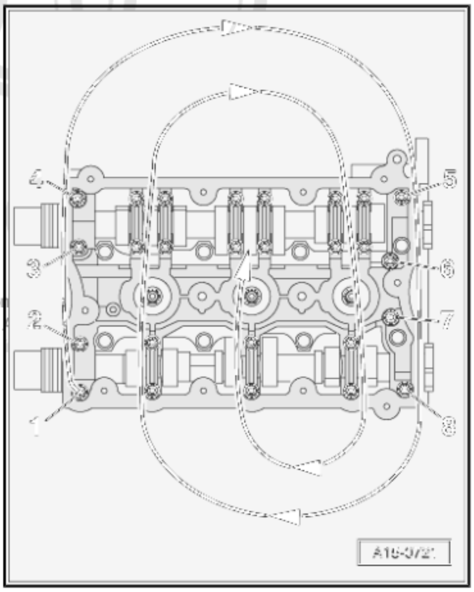
- Remove counterhold -T40030- from camshafts.
- Unscrew bolts -1 ... 6- and remove housing for camshaft control valves.



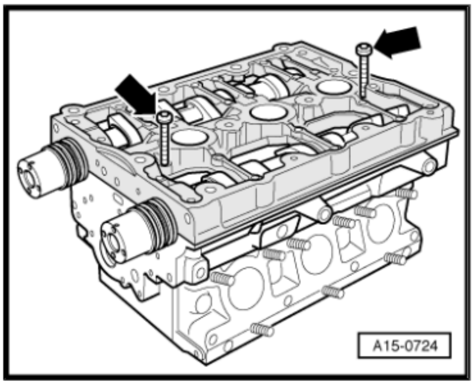
- Unscrew bolts -1 ... 6- and remove housing for Hall sender.



- Loosen bolts on ladder frame in the sequence shown by the numbers and then following the arrows.



- Press off ladder frame using M6 bolts -arrows-.
- Carefully remove ladder frame.



Installing

Note

Renew seals and gaskets.

- Crankshaft locked in position with locking pin -T40026- .

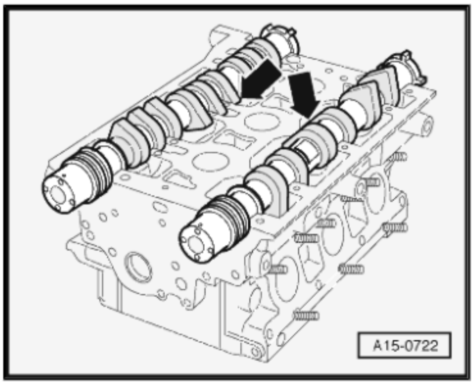
WARNING

Wear safety goggles.

- Remove remaining sealant from cylinder head and ladder frame using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Lubricate running surfaces of the camshafts.

Cylinder head (left-side):

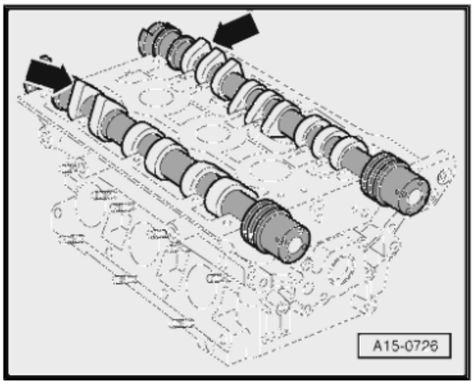
- Position camshafts in cylinder head as illustrated.
- The cams of No. 5 cylinder point downwards at equal angles -arrows-.



Cylinder head (right-side):

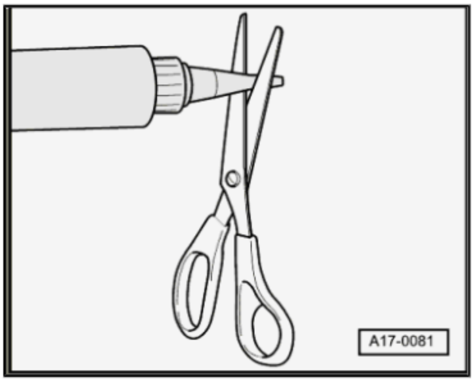
– Position camshafts in cylinder head as illustrated.

- The cams of No. 3 cylinder point upwards at equal angles -arrows-.



Continuation for both sides:

– Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).

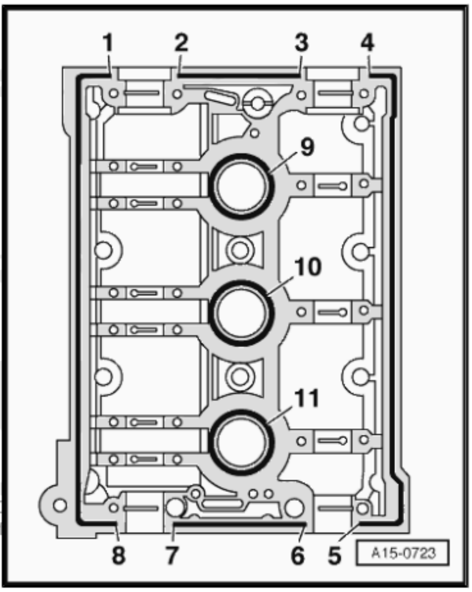


– Apply sealant to the clean sealing surface on the ladder frame as illustrated.

- The bead of sealant should be approx. 1.2 mm wide.
- The sealant bead must be at least 5 mm away from the camshaft bearings at the points -1 ... 8- in the illustration.
- Additionally apply a ring of sealant on the sealing surface around each spark plug hole -9 ... 11-.

Note

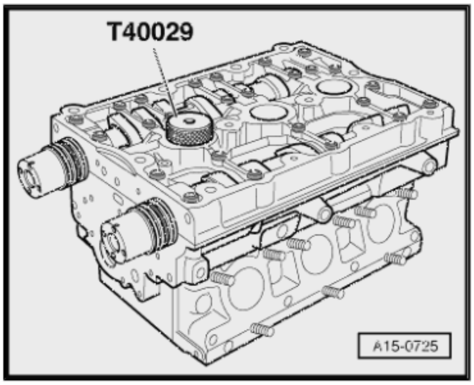
The bead of sealant must be applied exactly according to these instructions, otherwise excess sealant can get into the camshaft bearings.



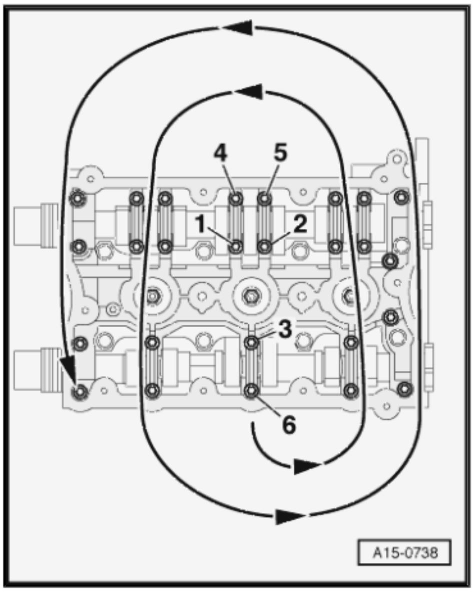
– Fit ladder frame immediately and fix in position using mandrel -T40029- .

Note

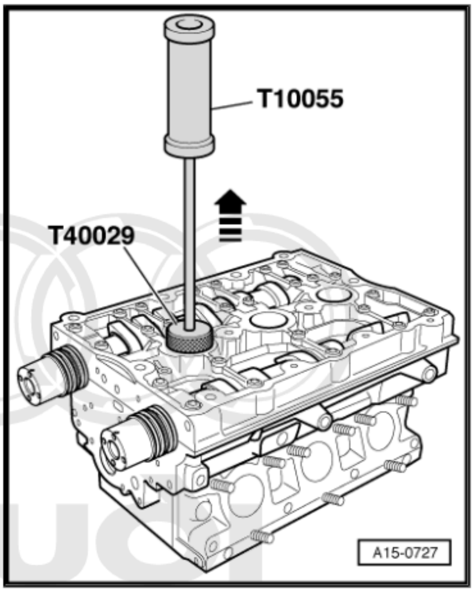
- ♦ *The ladder frame should be fitted and secured without delay, as the sealant starts hardening immediately.*
- ♦ *After installing the ladder frame, wait about 30 minutes for the sealant to dry.*



- To start with, tighten bolts on retaining frame hand-tight: tighten uniformly in the sequence shown by the numbers, and then following the arrows.
- The ladder frame should make contact with the cylinder head over the full surface.
- Tighten bolts securing ladder frame to final torque (10 Nm).

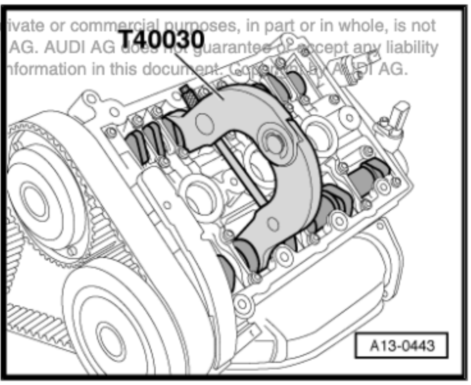


- Pull mandrel -T40029- out of cylinder head and ladder frame using puller -T10055- .



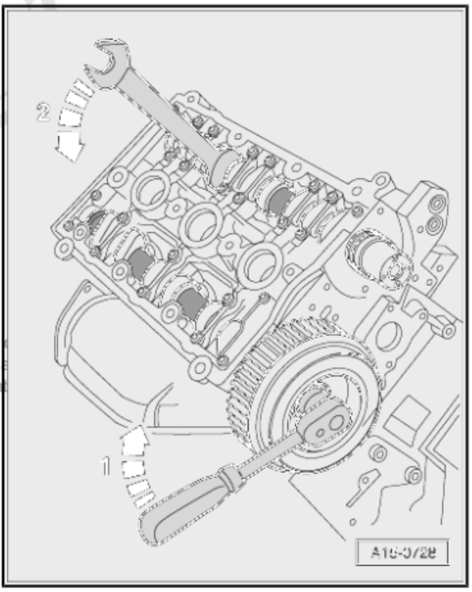
Cylinder head (left-side):

- Attach counterhold -T40030- to camshafts.
- Expand counterhold -T40030- by means of the threaded spindle (tightening torque max. 10 Nm) until it is seated with zero play.

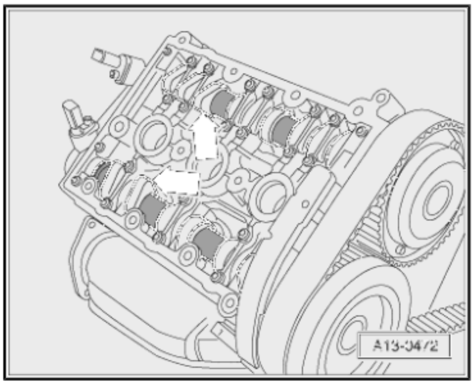


Cylinder head (right-side):

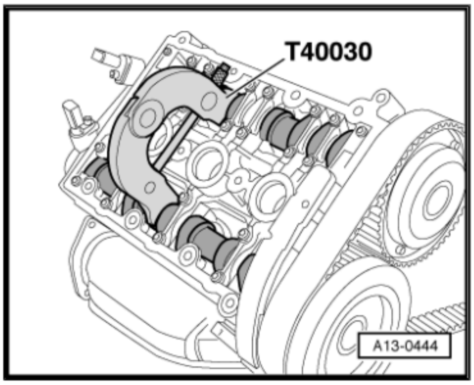
- Install camshaft sprocket on exhaust camshaft.
- Rotate exhaust camshaft -arrow 1- and inlet camshaft -arrow 2- 30° in direction of -arrows- ...



- ... until cams -arrows- at No. 3 cylinder on inlet and exhaust camshafts are positioned as shown in illustration.

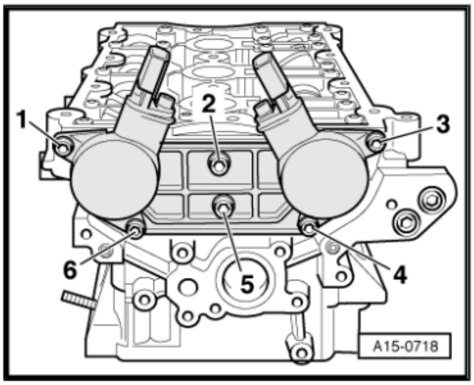


- Attach counterhold -T40030- to camshafts.
- Remove camshaft sprocket from exhaust camshaft again.

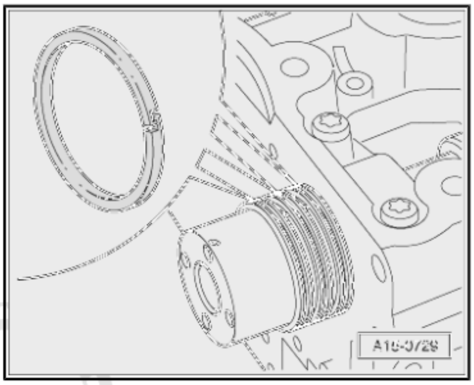


Continuation for both sides:

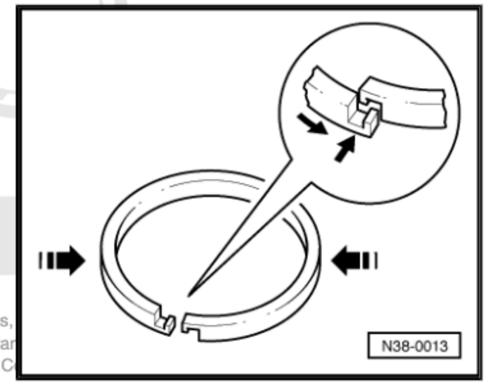
- Install housing for Hall sender and tighten bolts -1 ... 6-.



- Check that piston rings are installed on camshafts and that ends of piston rings are hooked together.

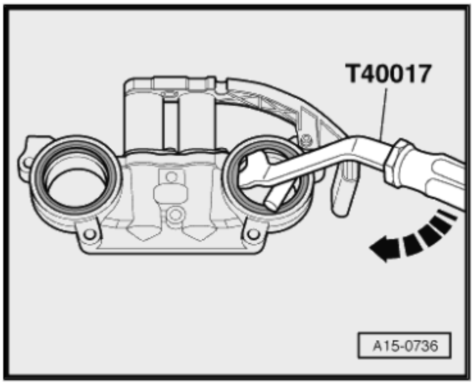


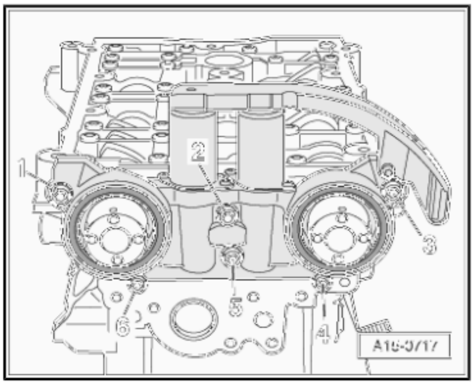
- If necessary, hook ends of piston rings -arrows- together as illustrated.



Note

If camshaft oil seals are being renewed, they must be pried out using lever -T40017- before installing housing for camshaft control valves. Installing camshaft oil seals ⇒ page 103 .





- Install housing for camshaft control valves and tighten bolts -1 ... 6-.

Perform further installation in reverse order, paying attention to the following:

- Install combination valve for secondary air system: left-side ⇒ page 235 , right-side ⇒ page 236 .
- Install toothed belt (adjust valve timing) ⇒ page 69 .

Note

- *Engine is not to be started for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*

Tightening torques

Component	Nm
Ladder frame to cylinder head	10
Housing for Hall sender to cylinder head	10
Housing for camshaft control valves to cylinder head	10
Toothed belt guard (rear) to cylinder head/ cylinder block	10 [15]

[15] Renew bolts.

4.6 Checking hydraulic bucket tappets

Special tools and workshop equipment required

- Feeler gauge
- Wood or plastic wedge

Note

- *Hydraulic bucket tappets cannot be serviced.*
- *Irregular valve noises when starting engine are normal.*

Test sequence

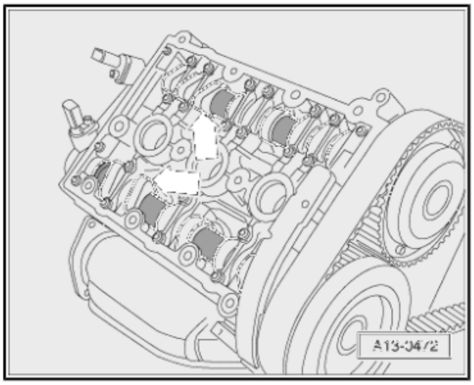
- Start engine and run until coolant temperature reaches approx. 80°C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note

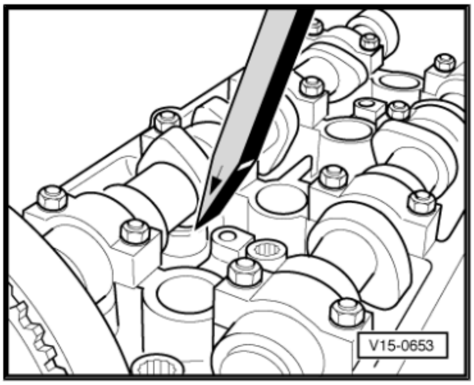
If the irregular valve noises stop but recur repeatedly during short trips, renew the oil retention valve. Fitting location of oil retention valve: beneath cover on intake manifold ⇒ page 157 .

If the hydraulic tappets are still noisy, locate defective tappet as follows:

- Remove cylinder head cover: left-side ⇒ page 74 , right-side ⇒ page 76 .
- Rotate crankshaft clockwise at central bolt for toothed belt sprocket until cams of cylinder to be checked are pointing upwards -arrows-.



- Determine clearance between cam and bucket tappet by pressing down bucket tappet with a suitable wood or plastic wedge.



If it is possible to insert a feeler gauge of 0.20 mm between camshaft and bucket tappet:

- Renew the bucket tappet; see Removing and installing camshafts and camshaft adjuster ⇒ page 105 .

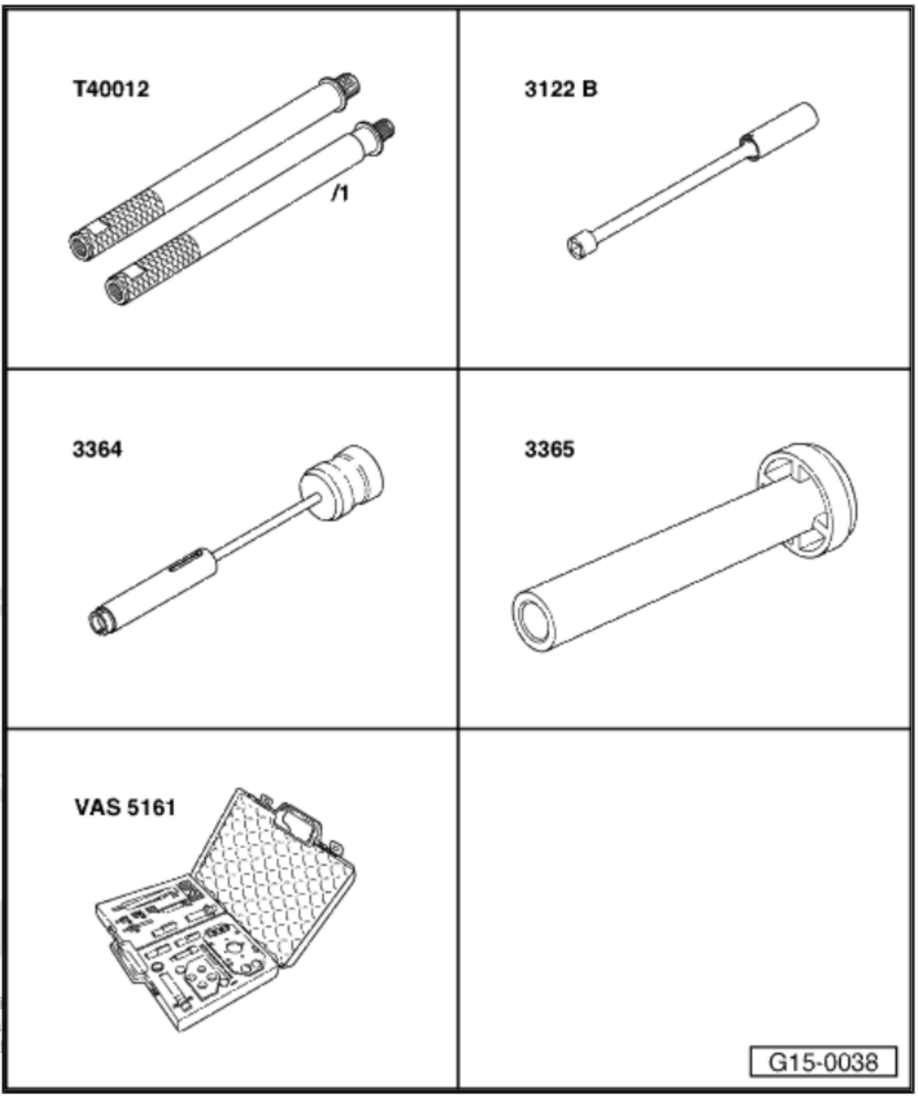
Note

- *Engine is not to be started for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- *After working on the valve gear, turn the engine carefully at least 2 rotations by hand to ensure that none of the valves make contact when the starter is operated.*

4.7 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

- Adapter -T40012-
- Spark plug socket -3122 B-
- Puller for valve stem oil seal -3364-
- Press tool for valve stem oil seal -3365-
- Disassembly and assembly tool -VAS 5161-



Removing

- Cylinder head installed.

– Remove the camshafts ⇒ page 105 .

Note

Make sure that the hydraulic bucket tappets are not interchanged; mark allocation on rear with a waterproof felt-tipped pen.

– Remove the bucket tappets out of the guides.

– Place the bucket tappets down on a clean surface with the contact surface facing downwards in the order that they were removed.

– Remove spark plugs with spark plug spanner -3122 B- .

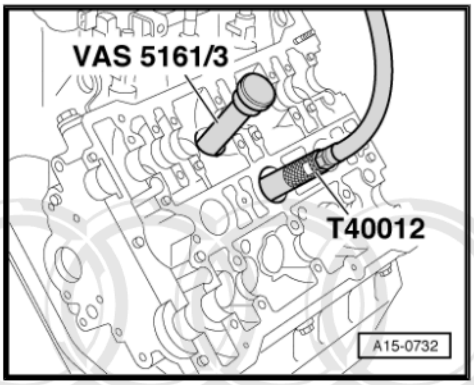
– Set piston of the respective cylinder to “bottom dead centre”.

Screw adapter -T40012- with seal hand-tight into corresponding spark plug thread, connect to compressed air hose and apply a steady pressure.

- Air pressure: at least 6 bar

– Insert punch -VAS 5161/3- into bucket tappet guide.

– Knock valve cotters on all five valves loose using a plastic hammer.



Inlet side:

– Screw snap-in device -VAS 5161/6- with interlocking fork -VAS 5161/5- into threaded hole on cylinder head.

– Push guide bush -VAS 5161/13- into bucket tappet guide of the valve to be removed until stop.

- Installation position: knurled surfaces face perpendicular to direction of travel.

– Slide knurled spacer ring -VAS 5161/17- onto assembly cartridge -VAS 5161/8- .

– Insert assembly cartridge into guide bush.

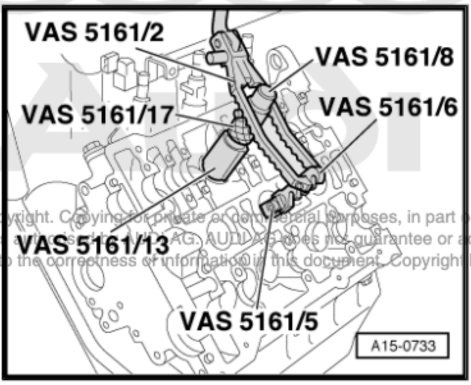
– Attach pressure fork -VAS 5161/2- to snap-in device -VAS 5161/6- and push assembly cartridge down.

– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the cartridge.

– Release the pressure fork.

– Take out assembly cartridge with spacer ring, guide bush, valve spring plate and valve spring.



Exhaust side:

– Screw snap-in device -VAS 5161/6- with interlocking fork -VAS 5161/5- into threaded hole on cylinder head.

– Push guide bush -VAS 5161/14- as far as it will go into bucket tappet guide for valve to be removed.

- Installation position: knurled surfaces face perpendicular to direction of travel.

– Slide knurled spacer ring -VAS 5161/17- onto assembly cartridge -VAS 5161/8- .

– Insert assembly cartridge into guide bush.

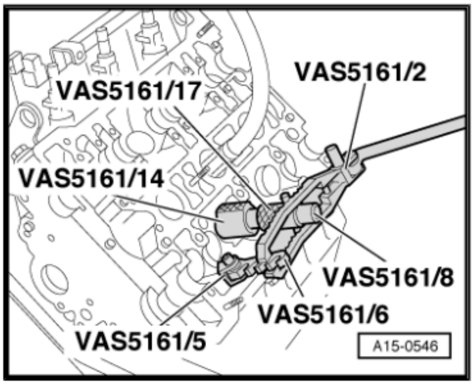
– Attach pressure fork -VAS 5161/2- to snap-in device -VAS 5161/6- and push assembly cartridge down.

– At the same time, turn knurled screw of assembly cartridge clockwise until ends engage in valve cotters.

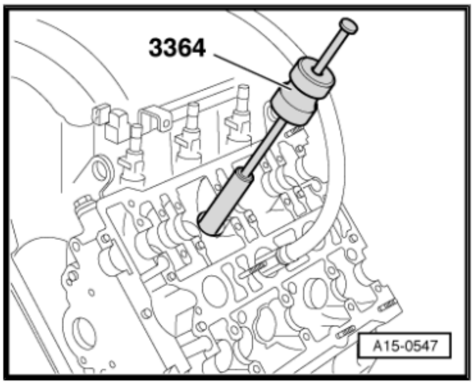
– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and enter into cartridge.

– Release the pressure fork.

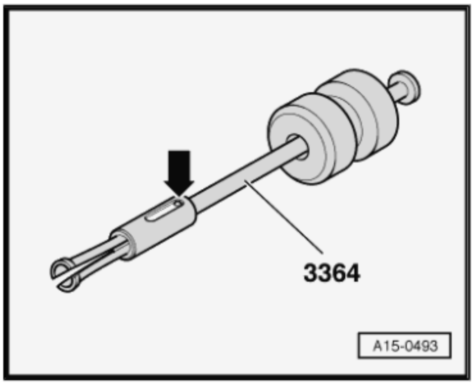
– Take out assembly cartridge with spacer ring, guide bush, valve head and valve spring.



Continuation for both sides:

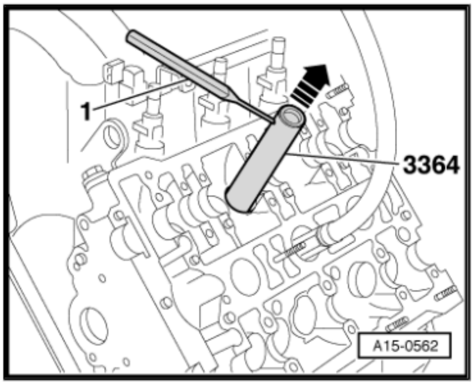


- Pull off valve stem oil seal with puller for valve stem oil seal -3364- .



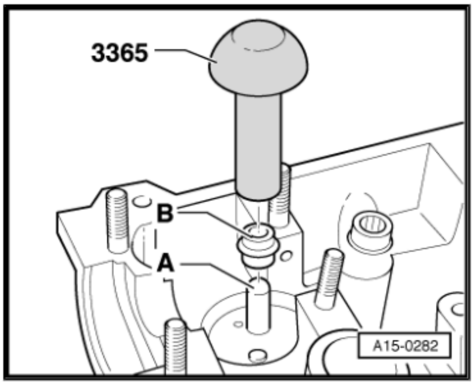
If the puller -3364- cannot be used on some of the valve stem oil seals due to the confined space, proceed as follows:

- Knock pin -arrow- of puller -3364- out using a drift and remove the extractor attachment.



- Attach lower part of puller -3364- to valve stem oil seal.
- Secure puller -3364- with drift or roll-pin drift -1- as shown in the illustration.
- Apply an assembly lever to puller -3364- and pull out valve stem oil seal -arrow-.

Installing



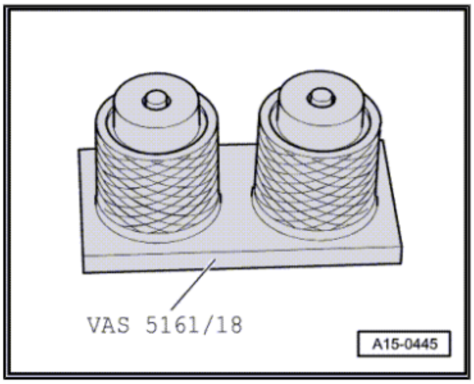
> Caution
>
> *Make sure valve stem oil seals are not damaged when installing.*
>
> - *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*

- Lightly lubricate sealing lip of valve stem oil seal.
- Slip valve stem oil seal over plastic sleeve.
- Carefully press the valve stem oil seal onto valve guide using fitting tool -3365- .
- Remove the plastic sleeve.

If valve cotters have been removed from assembly cartridge, they need to be put into insertion device -VAS 5161/18- first.

- Larger diameter of valve cotters faces upwards.

– Press assembly cartridge -VAS 5161/8- onto insertion device from above and take up valve cotters.



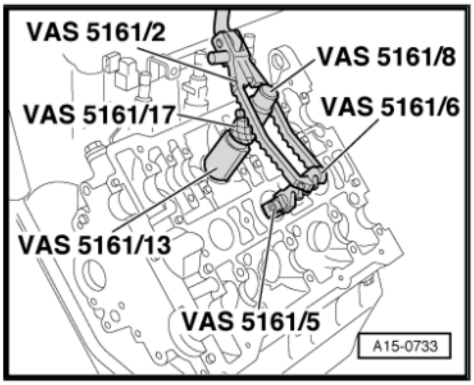
– Reinstall the assembly cartridge -VAS 5161/8- into guide bush -VAS 5161/13- and -VAS 5161/14- .

– Push pressure fork down and pull knurled screw upwards while turning to left and right - this will insert the valve cotters.

– Release the pressure fork with knurled screw still in pulled position.

– Insert bucket tappet.

– Install camshafts ⇒ page 105 .



Note

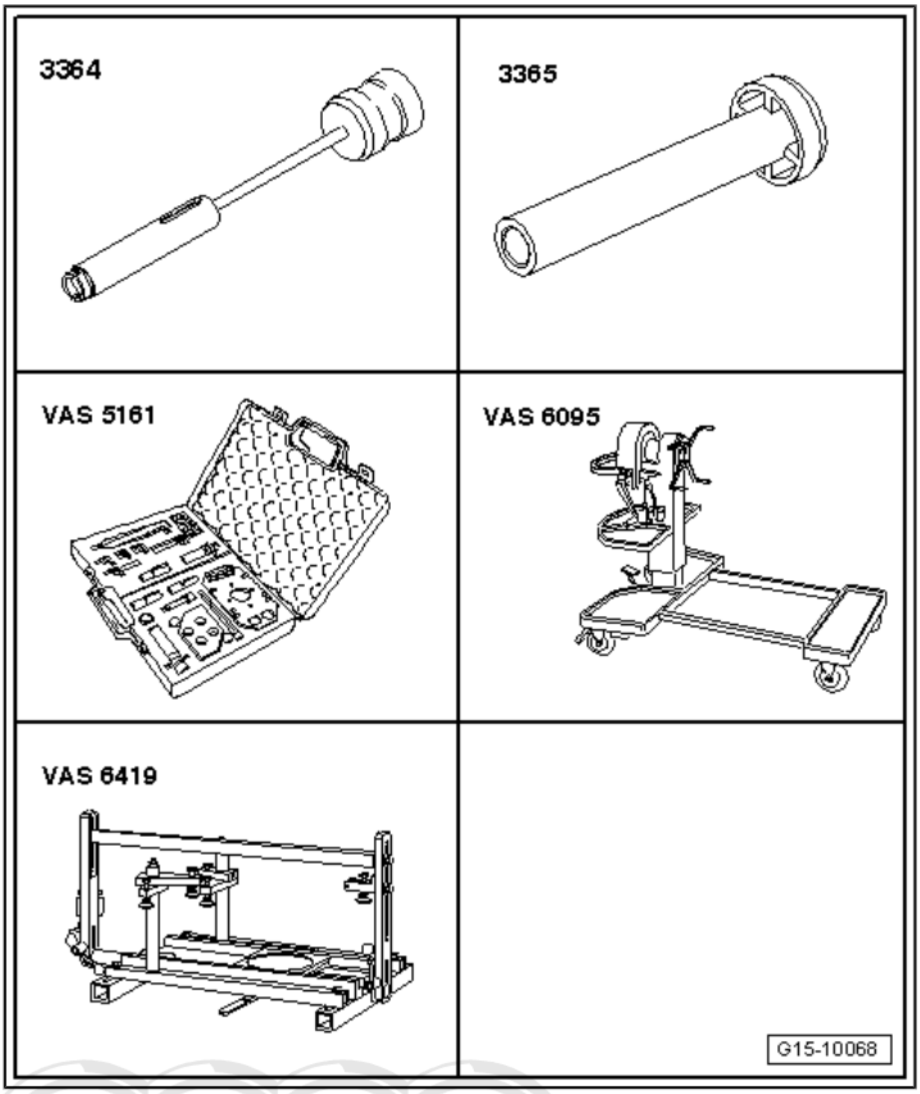
◆ *Engine is not to be started for approx. 30 minutes after installing camshafts. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*

◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

4.8 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

- Valve stem seal puller -3364-
- Valve stem seal fitting tool -3365-
- Removal and installation device for valve cotters -VAS 5161-
- Engine and gearbox support -VAS 6095-
- Cylinder head tensioning device -VAS 6419-



Removing

- Cylinder head installed.

– Remove camshafts ⇒ page 105 .

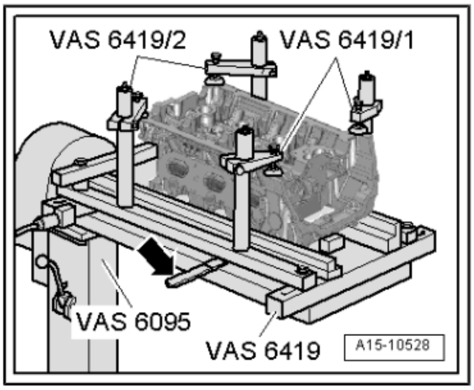
Note

Make sure that the hydraulic bucket tappets are not interchanged; mark allocation on rear with a waterproof felt-tipped pen.

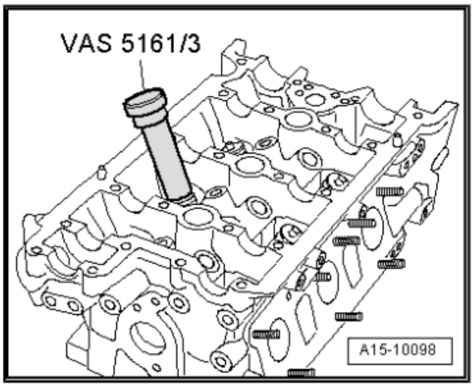
– Remove the bucket tappets out of the guides.

– Place the bucket tappets down on a clean surface with the contact surface facing downwards in the order that they were removed.

- Insert cylinder head tensioning device -VAS 6419- into engine and gearbox support -VAS 6095- .
- Secure cylinder head in cylinder head tensioning device, as shown in illustration.
- Connect cylinder head tensioning device to compressed air.
- Using lever -arrow-, slide air pad under combustion chamber where valve stem oil seal is to be removed.
- Apply just enough compressed air to bring air pad into contact with valve heads.

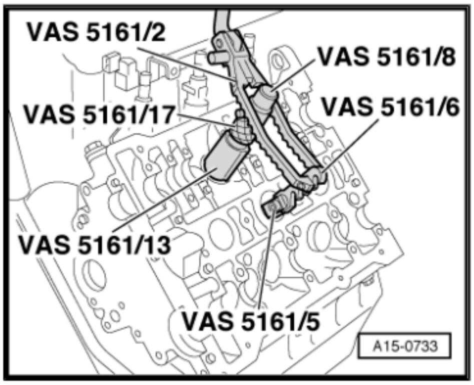


- Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.

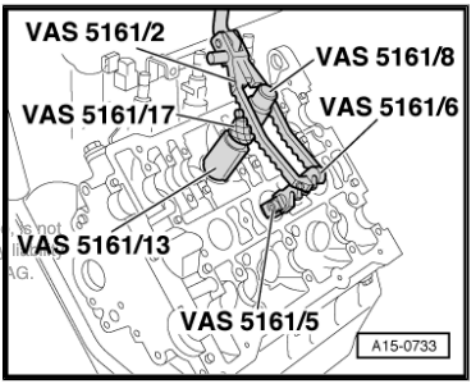


Inlet side:

- Screw snap-in device -VAS 5161/6- with interlocking fork -VAS 5161/5- into threaded hole on cylinder head.
- Push guide bush -VAS 5161/13- as far as it will go into bucket tappet guide for valve to be removed.
- Installation position: knurled surfaces face perpendicular to direction of travel.
- Slide knurled spacer ring -VAS 5161/17- onto assembly cartridge -VAS 5161/8- .
- Insert assembly cartridge into guide bush.
- Attach pressure fork -VAS 5161/2- to snap-in device -VAS 5161/6- and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until ends engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and enter into cartridge.

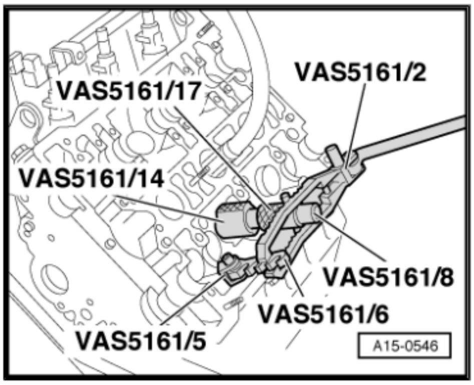


- Release the pressure fork.
- Take out assembly cartridge with spacer ring, guide bush, valve head and valve spring.



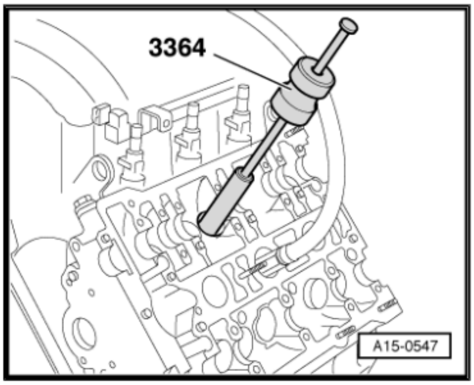
Exhaust side:

- – Screw snap-in device -VAS 5161/6- with interlocking fork -VAS 5161/5- into threaded hole on cylinder head.
- – Push guide bush -VAS 5161/14- into bucket tappet guide of the valve to be removed until stop.
- • Installation position: knurled surfaces face perpendicular to direction of travel.
- – Slide knurled spacer ring -VAS 5161/17- onto assembly cartridge -VAS 5161/8- .
- – Insert assembly cartridge into guide bush.
- – Attach pressure fork -VAS 5161/2- to snap-in device -VAS 5161/6- and push assembly cartridge down.
- – At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- – Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the cartridge.
- – Release the pressure fork.
- – Take out assembly cartridge with spacer ring, guide bush, valve spring plate and valve spring.



Continuation for both sides:

- – Pull off valve stem oil seal with valve stem seal puller -3364- .

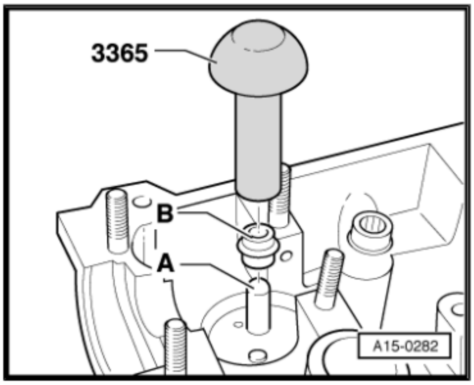


Installing

Caution

Make sure valve stem oil seals are not damaged when installing.

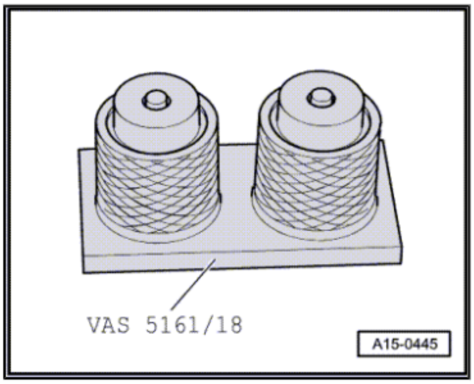
- ♦ *New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.*



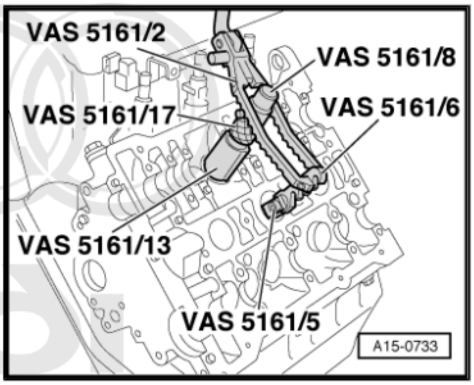
- – Lightly lubricate sealing lip of valve stem oil seal.
- – Slip valve stem oil seal over plastic sleeve.
- – Carefully press valve stem oil seal down onto valve guide using fitting tool -3365- .
- – Remove plastic sleeve.

If valve cotters have been removed from assembly cartridge, they need to be put into insertion device -VAS 5161/18- first.

- Larger diameter of valve cotters faces upwards.
- – Press assembly cartridge -VAS 5161/8- onto insertion device from above and pick up valve cotters.



- – Reinstall assembly cartridge -VAS 5161/8- in guide bush -VAS 5161/13- and -VAS 5161/14- .
- – Push pressure fork down and pull knurled screw upwards while turning to left and right — this will insert valve cotters.
- – Release pressure fork with knurled screw still in pulled position.
- – Insert bucket tappet.
- – Install camshafts ⇒ page 105 .



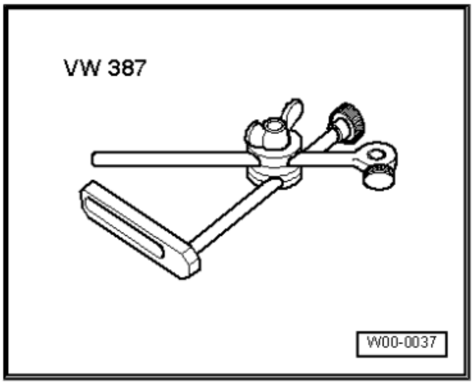
Note

- ◆ *After installing camshafts, wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

4.9 Checking valve guides

Special tools and workshop equipment required

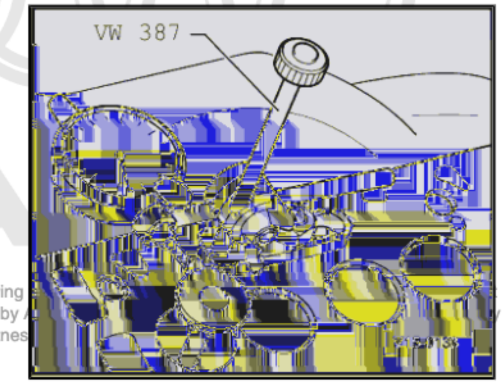
- ◆ Universal dial gauge bracket -VW 387-



- ◆ Dial gauge

Test sequence

- – Insert valve into valve guide. Only insert inlet valve into inlet guide and exhaust valve into exhaust guide, as the stem diameters are different.
- • End of valve stem must be flush with valve guide.
- – Determine amount of sideways play.
- • Wear limit (sideways play): 0.8 mm.



Note

- ♦ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ♦ *If the wear limit is exceeded, repeat the measurement with new valves. Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.*

4.10 Checking valves

- – Visually inspect for scoring on stem and surface of seat.

If scoring is clearly visible:

- – Renew the relevant valve.

4.11 Machining valve seats

Note

If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (machined):

Special tools and workshop equipment required

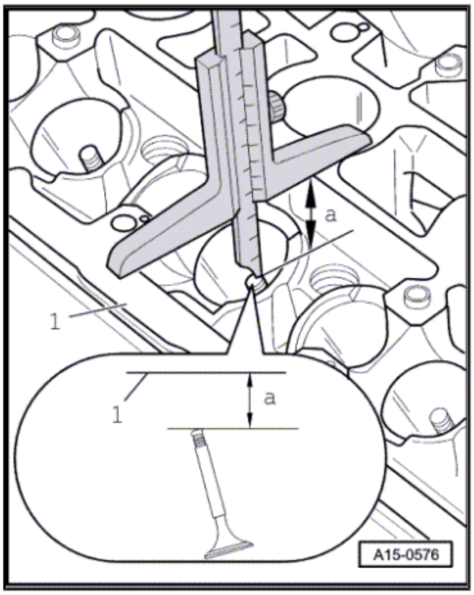
- ♦ Depth gauge
- ♦ Valve seat machining tool

Note

- ♦ *When servicing engines with leaking valves, it is not sufficient to machine (reface) the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high-mileage engines ⇒ page 122 .*
- ♦ *Valve seats should only be machined to the extent required to give a proper seating pattern.*
- ♦ *The maximum permissible machining dimension must be calculated before starting work.*
- ♦ *If the machining dimension is exceeded, the proper functioning of the hydraulic valve clearance compensation cannot be ensured. Renew the cylinder head.*

Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.



Note

If the valve has to be renewed as part of a repair, use a new valve for the measurement.

- Measure distance -a- between valve stem end (upper edge) and upper cylinder head surface with a depth gauge.
- Calculate the maximum permissible machining dimension using the measured distance and the minimum dimension.

Minimum dimensions		
Inlet valves (outer)	Inlet valve (centre)	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

Measured distance minus minimum dimension = max. permissible machining dimension.

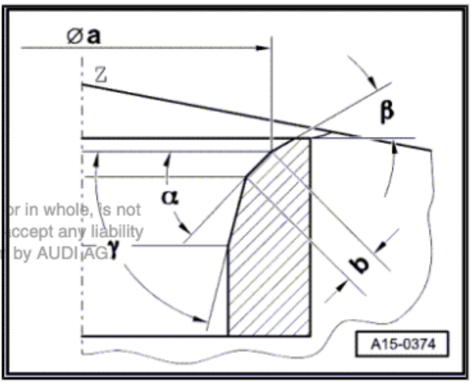
Example for inlet valve (outer):

	Measured distance	31.4 mm
–	Minimum dimension	– 31.0 mm
=	Max. permissible machining dimension	= 0.4 mm

Note

If the maximum permissible machining dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, renew the cylinder head.

Machining valve seats



Inlet valve seat

∅ a - 26.2 mm

b - 1.5 … 1.8 mm

Z - Lower edge of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle

Exhaust valve seat

∅ a - 29.0 mm

b - 1.8 mm

Z - Lower edge of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle

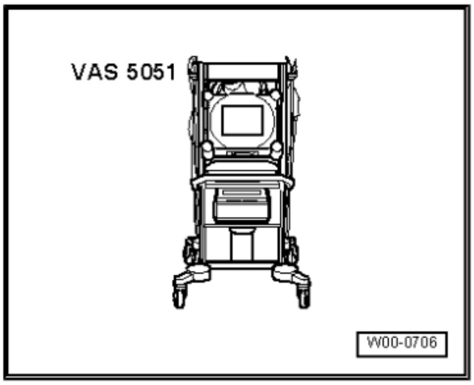
5 Checking camshaft adjustment

- ♦ By altering the valve timing the engine control unit varies the cylinder charge to suit the current engine load and rpm.
- ♦ The system employs a total of 4 camshaft control valves, which allow varying amounts of oil pressure to act on the timing control mechanism.
- ♦ The timing control for the exhaust camshafts has a single-step adjustment; the inlet camshafts have a continuous adjustment.

5.1 Testing the system

Special tools and workshop equipment required

- ♦ Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A-



WARNING

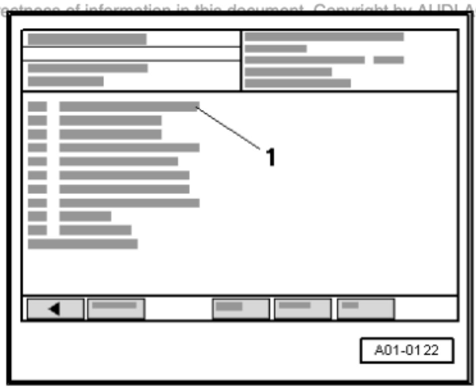
- ♦ *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- ♦ *If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

Test conditions

- • Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. Engine must be idling.
- • Coolant temperature at least 80°C.
- • Selector lever in position “P”.

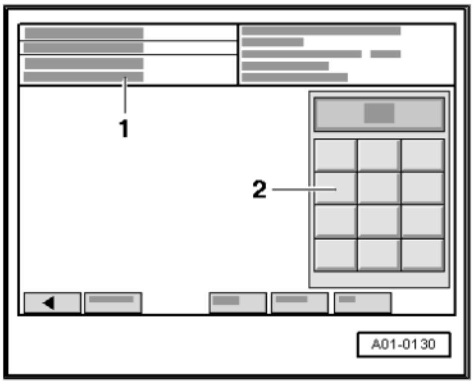
Test sequence

– Under -1- select diagnostic function “04 - Basic setting”.

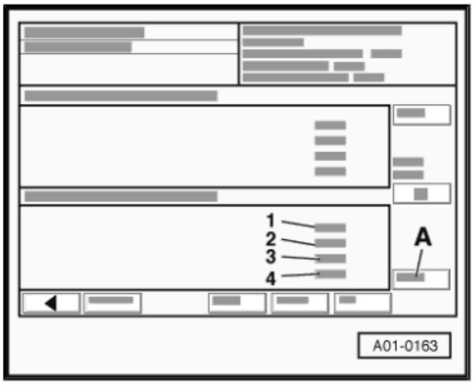


- Using the keypad -2-, enter "094" to select "Display group 094" and confirm entry with the Q key.

1 - Enter display group



- Activate basic setting by touching key -A-.
- Press the accelerator pedal and brake pedal simultaneously.
- The idling speed is increased to approx. 1900 rpm.
- Check specifications in display zones -3- and -4-.

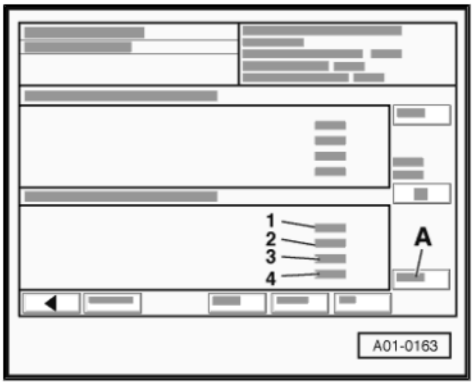


Display zone	Readout	Specification
3 and 4	Status of diagnosis: Test OFF Test ON Syst. OK Syst. n. OK.	Syst. OK

Note

If readout shows "Syst.n.OK": test camshaft adjustment (inlet) ⇒ page 128 .

- Press the ↑ button twice to advance to Display group 096.
- Activate basic setting by touching key -A-.
- Press the accelerator pedal and brake pedal simultaneously.
- The idling speed is increased to approx. 1900 rpm.
- Check specifications in display zones -3- and -4-.



Display zone	Readout	Specification
3 and 4	Status of diagnosis: Test OFF Test ON Syst. OK Syst. n. OK.	Syst. OK

Note

If readout shows “Syst.n.OK”: test camshaft adjustment (exhaust) ⇒ page 127 .

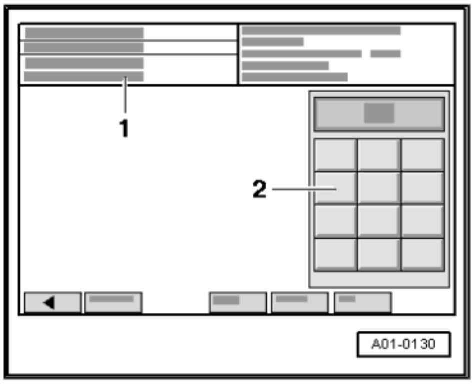
– Press the ↵ key.

5.2 Testing camshaft adjustment (exhaust)

– Switch over to the diagnosis function “08 - Read measured value block”.

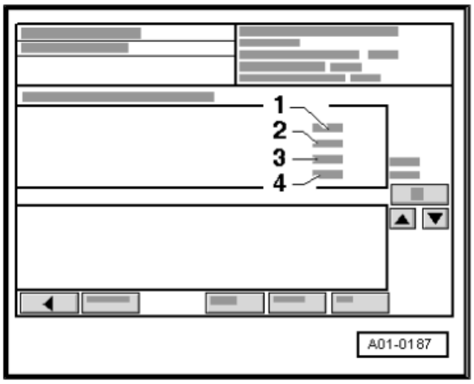
– Use keypad -2- to enter “090” for “Display group number 090” and confirm by touching the Q key.

1 - Enter display group



– Check specified values in display zones -2-, -3- and -4-.

- Engine running at idling speed.



Display zone	Readout	Specification
1	Engine speed	Idling
2	Camshaft timing control	Off
3	Adjustment bank 1	-3 … 3°CA
4	Adjustment bank 2	-3 … 3°CA

– Perform test drive.

– Accelerate the vehicle from 2000 rpm at full throttle in third gear.

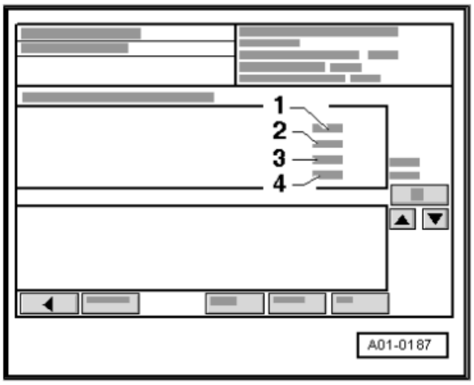
– Check specified values in display zones -2-, -3- and -4-.

Display zone	Readout	Specification
1	Engine speed	2000 … 5000 rpm
2	Camshaft timing control	On
3	Adjustment bank 1	19 … 25°CA
4	Adjustment bank 2	19 … 25°CA

Note

- *If specification is not obtained: test relevant camshaft control valve (exhaust) ⇒ page 129*
- *If the readout only shows a value between 3.0° CA (crankshaft angle) and 19.0° CA during the test drive, this indicates that the solenoid valve for camshaft adjustment is working correctly and feeding the oil pressure to the camshaft adjustment mechanism, but the mechanism is not able to reach its end position (possibly because it is not moving freely).*

5.3 Checking camshaft adjustment (inlet)



– Press the ↑ button to advance to Display group 091.

• Engine running at idling speed.

– Check specifications in display zones -3- and -4-.

Display zone	Readout	Specification
1	Engine speed	Idling
2	Duty cycle	15 … 17%
3	Adjustment bank 1	-3 … 3°CA
4	Adjustment bank 2	-3 … 3°CA

– Perform test drive.

– Accelerate the vehicle from 2000 rpm at full throttle in third gear.

– Check specified values in display zones -2-, -3- and -4-.

Display zone	Readout	Specification
1	Engine speed	2000 … 5000 rpm
2	Duty cycle	60 … 100%
3	Adjustment bank 1	39 … 45°CA
4	Adjustment bank 2	39 … 45°CA

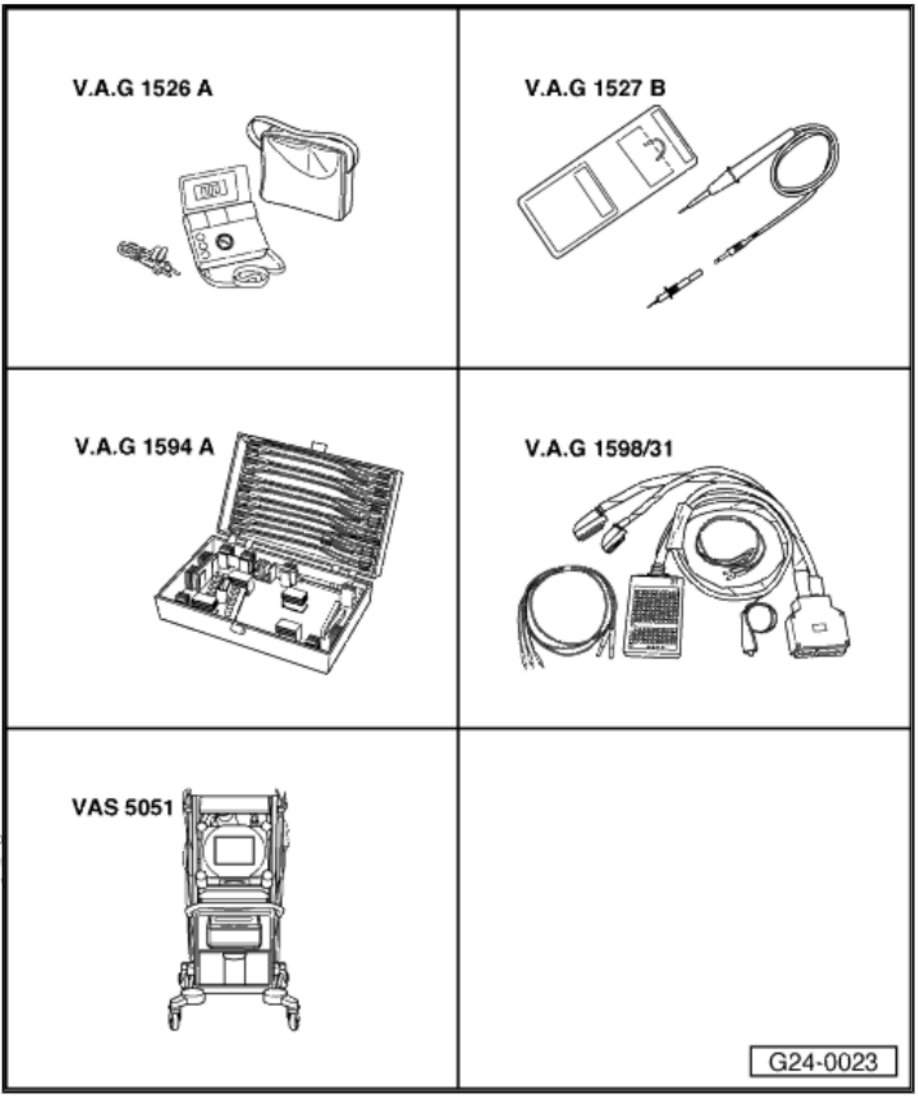
Note

- *If specification is not obtained: test relevant camshaft control valve (inlet) ⇒ page 129*
- *If the readout only shows a value between 3.0°CA (crankshaft angle) and 39.0°CA during the test drive, this indicates that the solenoid valve for camshaft adjustment is working correctly and feeding the oil pressure to the camshaft adjustment mechanism, but the mechanism is not able to reach its end position (possibly because it is not moving freely).*

5.4 Checking solenoid valves for camshaft adjustment

Special tools and workshop equipment required

- Hand-held multimeter -V.A.G 1526 A-
- Voltage tester -V.A.G 1527 B-
- Adapter set -V.A.G 1594 A-
- Test box -V.A.G 1598/31-
- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A-



Pro
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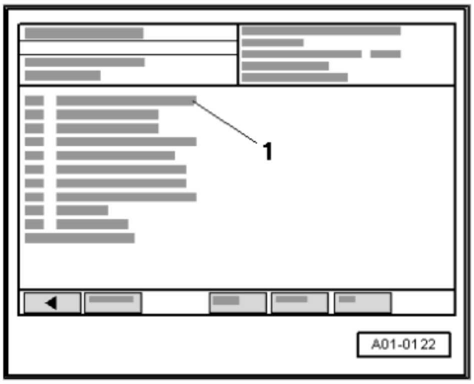
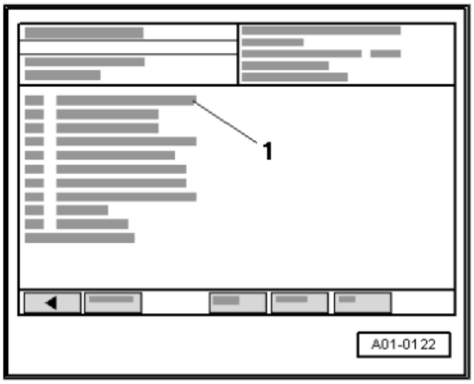


Actuating solenoid valves for camshaft adjustment (inlet)

- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.
- – Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.
- – Press the button → until the camshaft control valve 1 -N205- is actuated.
- The camshaft control valve 1 -N205- will be actuated for approx. 1 minute in intervals (clicking sound).
- – Press the button → until the camshaft control valve 2 -N208- is actuated.
- The camshaft control valve 2 -N208- will be actuated for approx. 1 minute in intervals (clicking sound).
- – Exit function “03 - Final control diagnosis” by pressing the ← key.
- – Switch off ignition.

If one of the valves is not actuated (does not click):

- – Perform electrical test of camshaft control valves ⇒ page 131 .



Actuating solenoid valves for camshaft adjustment (exhaust)

- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.
- – Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.
- – Press the button → until the camshaft control valve 1 (exhaust) -N318- is actuated.
- The camshaft control valve 1 (exhaust) -N318- will be actuated for approx. 1 minute in intervals (clicking sound).

- – Press the button → until the camshaft control valve 2 (exhaust) -N319- is actuated.
- The camshaft control valve 2 (exhaust) -N319- will be actuated for approx. 1 minute in intervals (clicking sound).
- – Exit function “03 - Final control diagnosis” by pressing the ← key.
- – Switch off ignition.

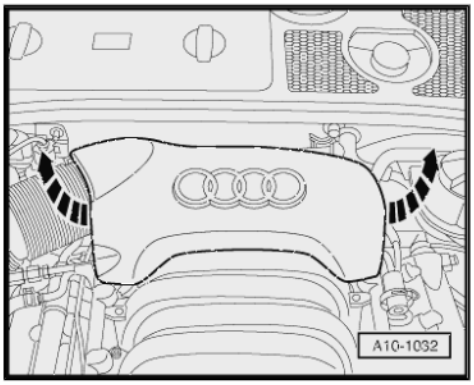
If one of the valves is not actuated (does not click):

- – Perform electrical test of camshaft control valves ⇒ page 131 .

5.5 Electrical test of solenoid valves for camshaft adjustment

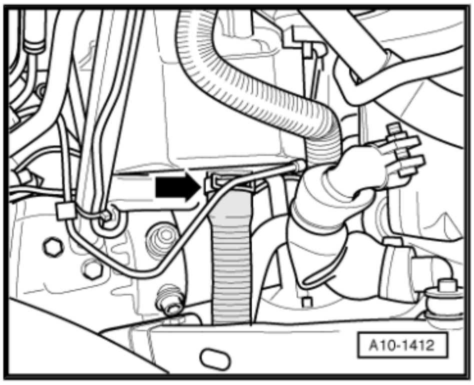
Cylinder bank 1 (right-side):

– Pull off rear engine cover -arrows-.



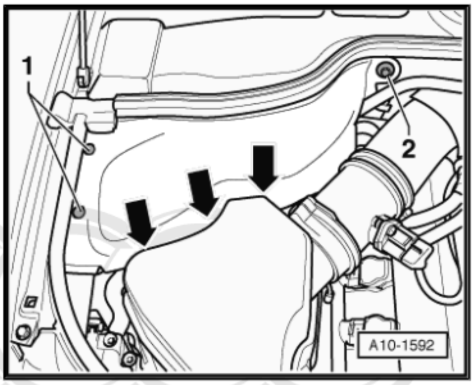
– Detach wheel housing liner (front right) at the front.

– Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



– Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.

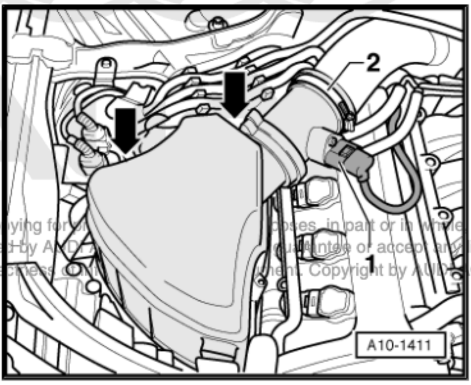
– Pull cover out of retainers -arrows-.



– Detach electrical connector -1-.

– Detach air intake hose -2- at air cleaner housing.

– Unscrew bolts -arrows- and remove air cleaner housing.



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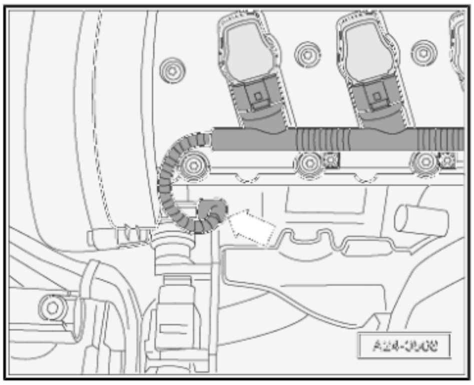
Continuation for both sides:

– Unplug connector -arrow- at connector adapter.

Note

The illustration shows cylinder bank 2 (left-side).



5.6 Checking internal resistance

Solenoid valve for camshaft adjustment (inlet):

– Connect multimeter (resistance test) between contacts -1- and -2-.

- Specification: 7.4 ... 8.2 Ω

Solenoid valve for camshaft adjustment (exhaust):

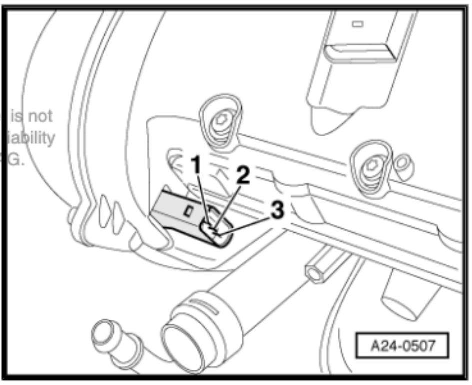
– Connect multimeter (resistance test) between contacts -2- and -3-.

- Specification: 12.8 ... 14.2 Ω

All models:

If specification is not reached:

– Renew relevant solenoid valve for camshaft adjustment.



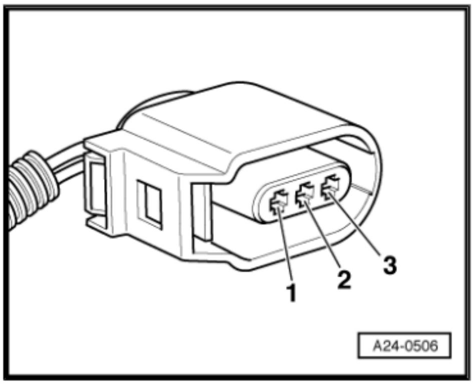
5.7 Checking voltage supply

Note

Fuse for solenoid valves for camshaft adjustment OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Connect voltage tester -V.A.G 1527 B- as follows:

Connector Contact	Measure against
-2-	Engine earth



– Switch on ignition.

- The LED should light up.

– Switch off ignition.

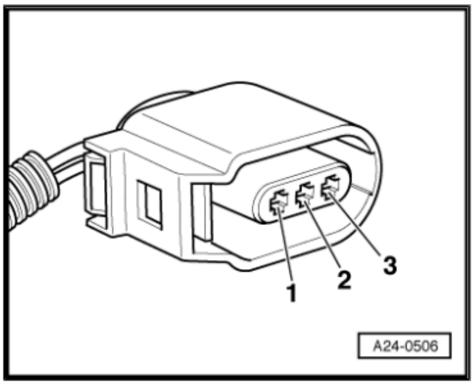
If the LED does not light up:

– Use current flow diagram to check for open circuit in wiring from contact -2- of connector via fuse to motronic current supply relay -J271- .

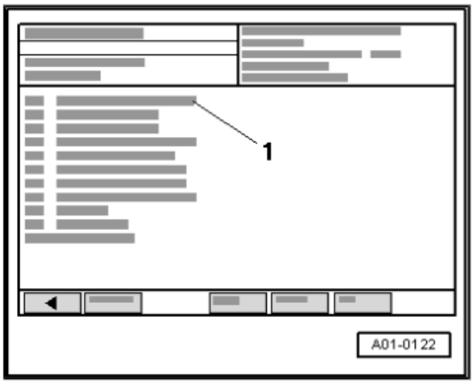
– If necessary repair wiring connection.

5.8 Checking activation

– Connect voltage tester -V.A.G 1527 B- as follows:



Solenoid valve for camshaft adjustment	Connector Contact
Inlet bank 1 -N205-	1 + 2
Inlet bank 2 -N208-	1 + 2
Exhaust bank 1 -N318-	2 + 3
Exhaust bank 2 -N319-	2 + 3



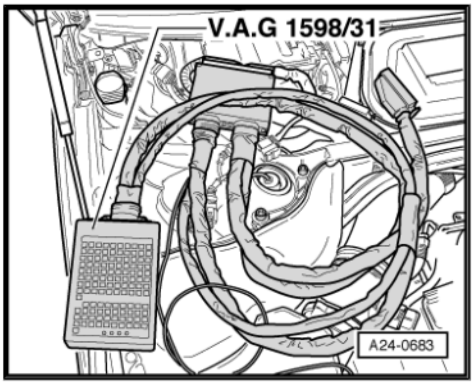
- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.

– Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.

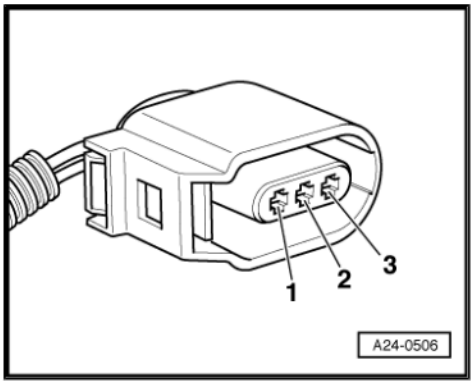
– Press the button → until the relevant camshaft control valve is actuated.

- The LED should flash.

If the LED lamp does not flash or lights up continuously:



– Connect test box -V.A.G 1598/31- to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24 .



– Check for open circuit and short to positive or earth in the following wiring:

Solenoid valve for camshaft adjustment	Connector Contact	Test box -V.A.G 1598/31- Socket
Inlet bank 1 -N205-	1	115
Inlet bank 2 -N208-	1	120
Exhaust bank 1 -N318-	1	22
Exhaust bank 2 -N319-	1	18

– If necessary repair wiring connection.

If the wiring is OK:

– Renew engine control unit.

If no fault is found:

– Renew the mechanical camshaft adjuster; see Removing and installing camshafts and camshaft adjuster ⇒ page 105 .

17 – Lubrication

1 Removing and installing parts of the lubrication system

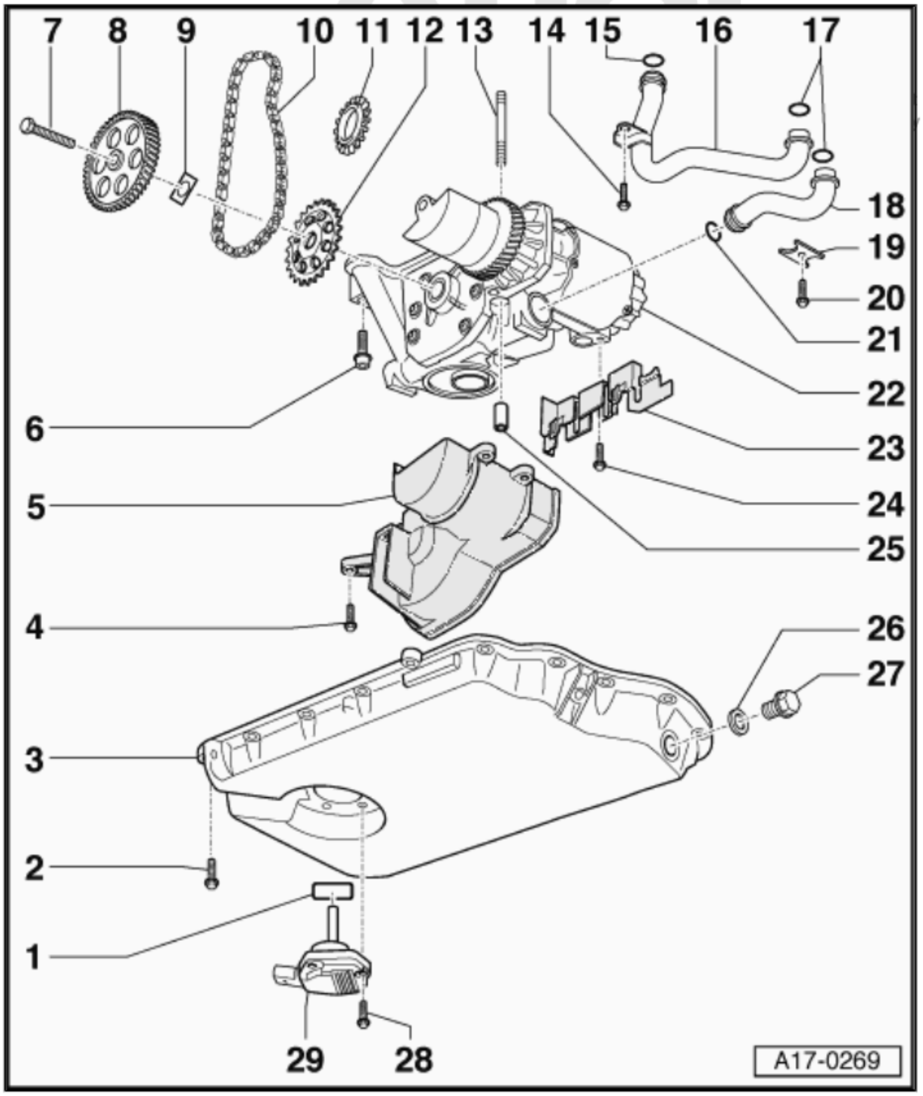
Note

- *If large quantities of metal particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage.*
- *The oil level must not be above Max. mark on dipstick – danger of damage to catalytic converter.*
- *Oil spray jet for piston cooling ⇒ page 144* .

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 4E .

Oil capacities ⇒ Data sheets for exhaust emission test.

1.1 Sump (bottom section), oil pump - exploded view of components



1 - Seal
  ☐ Renew

2 - 10 Nm
  ☐ Tighten in stages and in diagonal sequence

3 - Sump (bottom section)
  ☐ Removing and installing ⇒ page 135

4 - 10 Nm

5 - Baffle plate (front)

6 - 22 Nm
  ☐ Renew

7 - 20 Nm + 90° ($^{1}/_{4}$ turn) further
  ☐ Renew
  ☐ When installing, fit new diamond-coated washer ⇒ Item 9 (page 134) between gear and chain sprocket

8 - Drive gear for balance shaft
  ☐ When installing, fit new diamond-coated washer ⇒ Item 9 (page 134) between gear and chain sprocket

9 - Diamond-coated washer
  ☐ Renew

10 - Drive chain for oil pump
  ☐ Removing and installing

  ⇒ page 156
- ☐ Chain tensioner for drive chain ⇒ Item 14 (page 143)

11 - Drive chain sprocket for oil pump
- ☐ Removing and installing ⇒ page 156

12 - Chain sprocket for oil pump
- ☐ Installation position: Inscription faces to the rear
- ☐ When installing, fit new diamond-coated washer ⇒ Item 9 (page 134) between gear and chain sprocket
- ☐ Removing and installing ⇒ page 138

13 - Stud
- ☐ Self-locking
- ☐ Shorter thread goes into cylinder block

14 - 10 Nm

15 - O-ring
- ☐ Renew

16 - Oil pipe

17 - O-rings
- ☐ Renew

18 - Oil pipe

19 - Bracket for oil pipes

20 - 10 Nm

21 - O-ring
- ☐ Renew

22 - Oil pump
- ☐ With balance shaft
- ☐ Removing and installing ⇒ page 138

23 - Baffle plate (rear)

24 - 10 Nm
- ☐ Self-locking
- ☐ Renew

25 - 20 Nm +120° ($^1/_3$ turn) further
- ☐ Renew
- ☐ Apply locking fluid when fitting
- ☐ Locking fluid ⇒ Parts List

26 - Seal
- ☐ Renew

27 - Oil drain plug -30 Nm-

28 - 10 Nm

29 - Oil level/oil temperature sender -G266-

1.2 Removing and installing sump (bottom section)

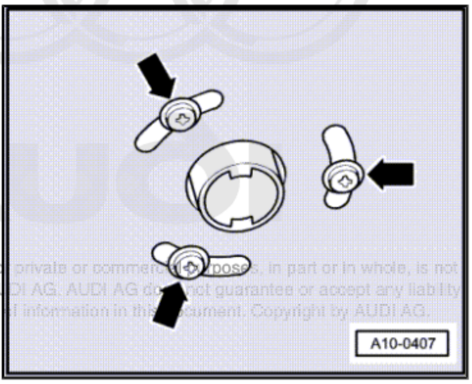
Special tools and workshop equipment required

- Drip tray
- Electric drill with plastic brush attachment

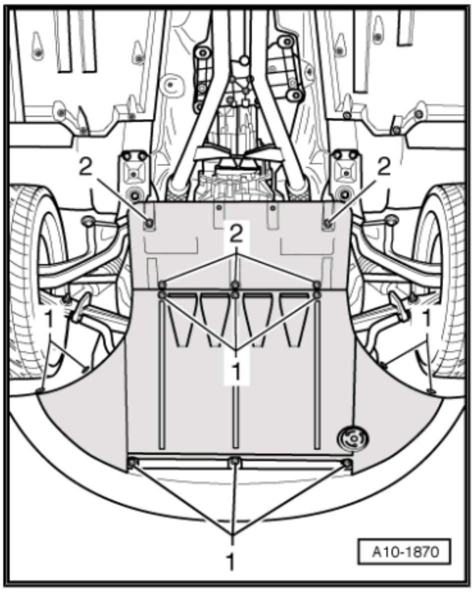
- ◆ Safety goggles
- ◆ Silicone sealant ⇒ Parts catalogue

Removing

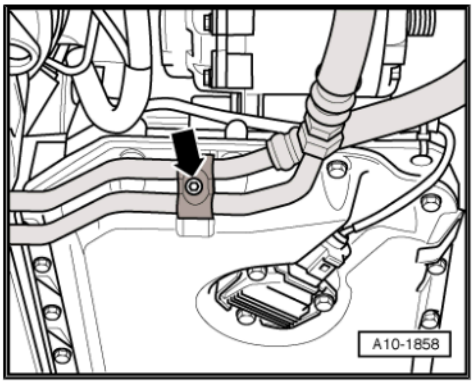
- – Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- – Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



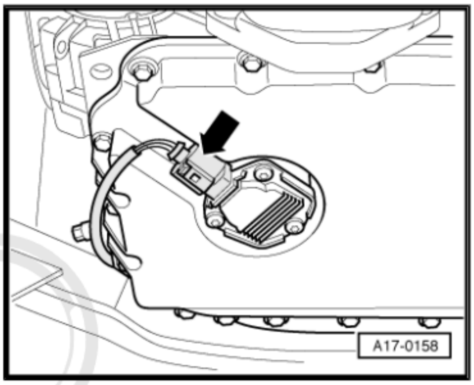
- – Loosen quick release fasteners -1- and remove front noise insulation.
- – Place drip tray below engine.
- – Drain engine oil.



- – Unscrew bracket for ATF line (right-side) at bottom section of sump -arrow-.



– Unplug electrical connector at oil level/oil temperature sender -G266- -arrow- and move wire clear.



– Place drip tray under the engine (more oil will come out).

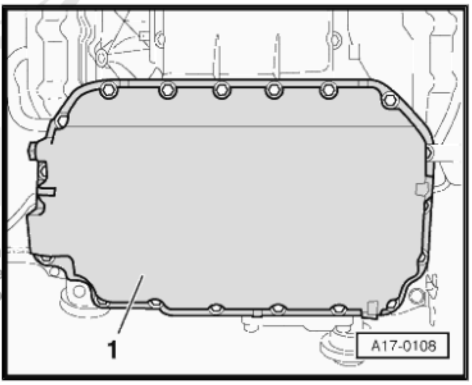
– Unbolt sump (bottom section) -1- and carefully remove.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

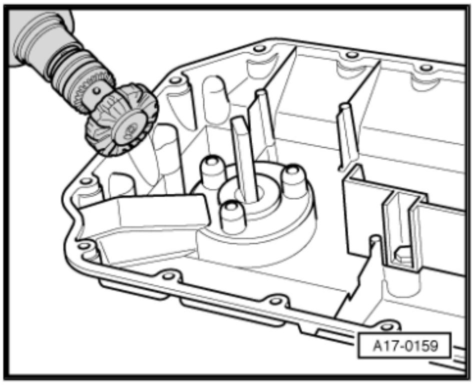


– Remove remaining sealant on bottom and top section of sump with a rotating plastic brush or similar.

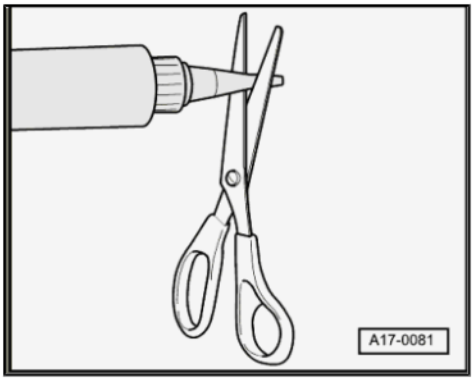
WARNING

Wear safety goggles.

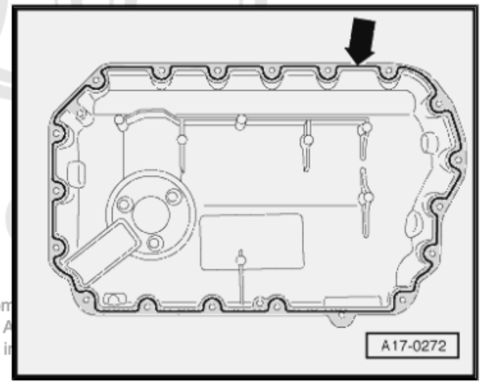
– Clean sealing surfaces; they must be free of oil and grease.



– Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).



- Apply bead of silicone sealant onto the clean sealing surface of the sump (bottom section), as illustrated.



- The bead of sealant should be approx. 1.5 mm wide -arrow-.

Note

- *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- *The sump (bottom section) must be installed within 5 minutes after applying the silicone sealant.*

- Fit sump (bottom section) and tighten all bolts initially to 5 Nm in diagonal sequence.
- Tighten bolts securing sump (bottom section) to 10 Nm in diagonal sequence.
- Fill up with engine oil and check oil level ⇒ page 161 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

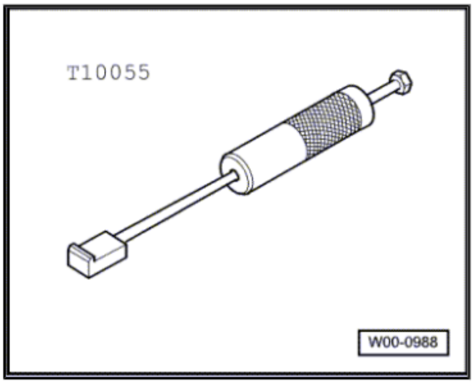
Tightening torques

Component	Nm
Sump (bottom section) to sump (top section)	10
Oil drain plug	30

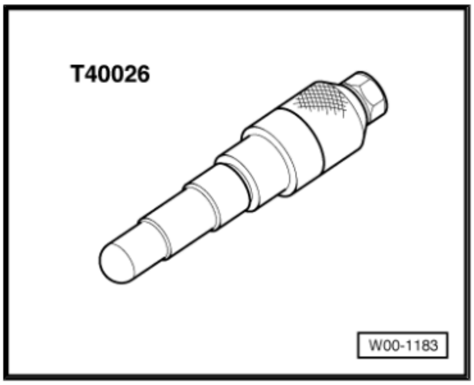
1.3 Removing and installing oil pump

Special tools and workshop equipment required

- Puller -T10055-



- Locking pin -T40026-

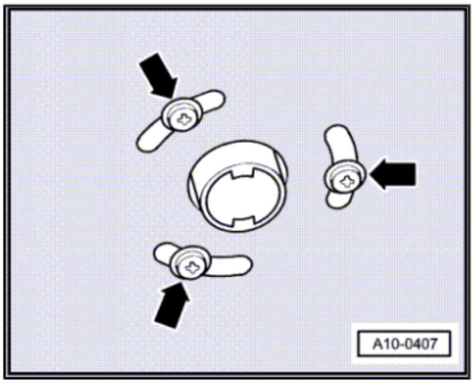


- Drill, ∅ 3 mm

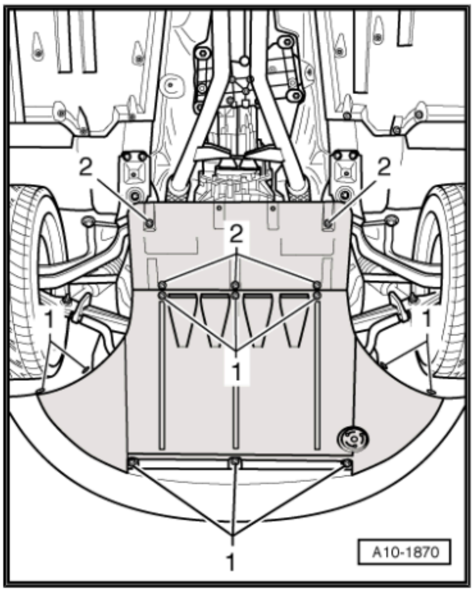
- ♦ Drip tray
- ♦ Sealant ⇒ Parts catalogue
- ♦ Locking fluid ⇒ Parts List

Removing

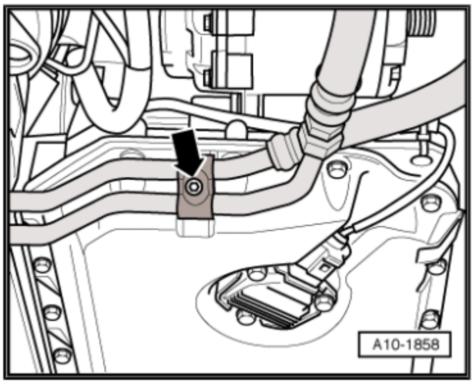
- – Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- – Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



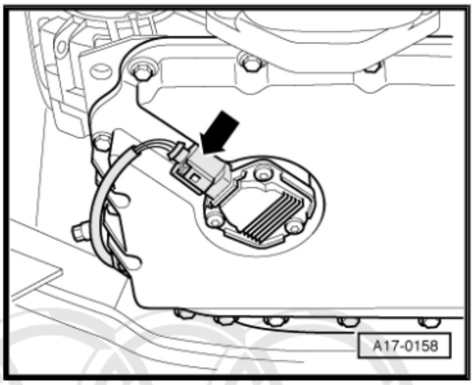
- – Loosen quick release fasteners -1- and remove front noise insulation.
- – Place drip tray below engine.
- – Drain off engine oil.



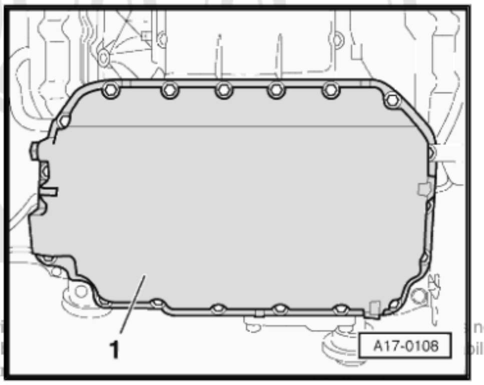
- – Unscrew bracket for ATF line (right-side) at bottom section of sump -arrow-.



- Unplug electrical connector at oil level and oil temperature sender -G266- -arrow- and move wire clear.



- Place drip tray under the engine (more oil will come out).
- Unbolt sump (bottom section) -1- and carefully remove.



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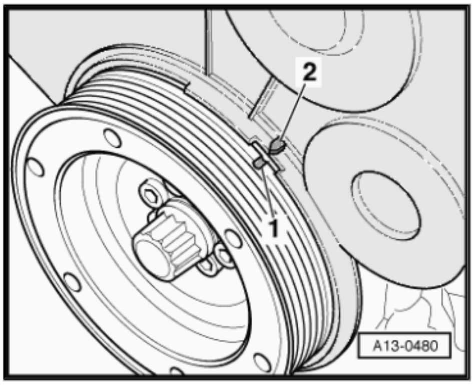
with respect to the correct

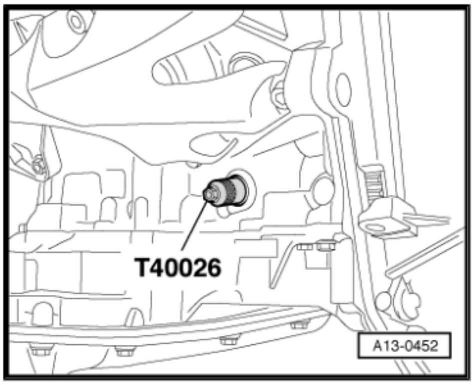
- Set crankshaft to markings for TDC of No. 3 cylinder by turning central bolt on crankshaft sprocket in normal direction of rotation.
- Notch -1- should align with marking -2-.



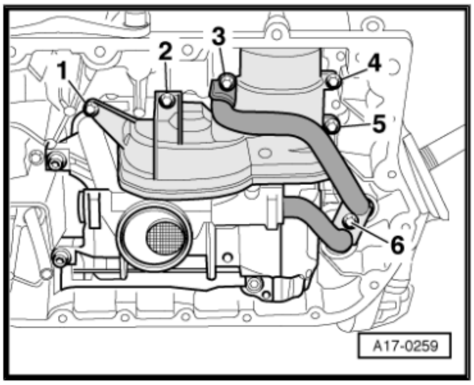
- Unscrew plug for TDC marking from cylinder block.
- Screw locking pin -T40026- into hole where plug has been removed and tighten.

Note

If necessary, turn crankshaft slightly backwards and forwards.



- Unscrew bolts -3- and -6- and remove oil pipes.

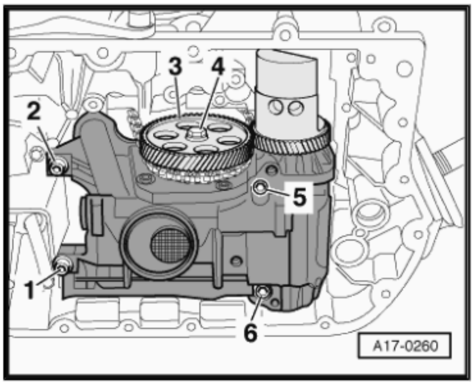


Note

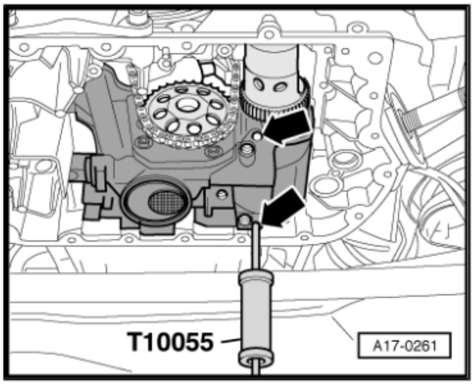
Some oil will come out when oil pipes are removed.

- Unscrew bolts -1-, -2-, -4- and -5- and remove baffle plate (front).

- Unscrew bolt -4- and remove drive gear -3- for balance shaft.
- Remove diamond-coated washer from drive gear.
- Unscrew bolts -1- and -2- and nuts -5- and -6-.



- Screw puller -T10055- into M8 holes -arrows- on oil pump in alternating sequence and pull oil pump off of cylinder block.



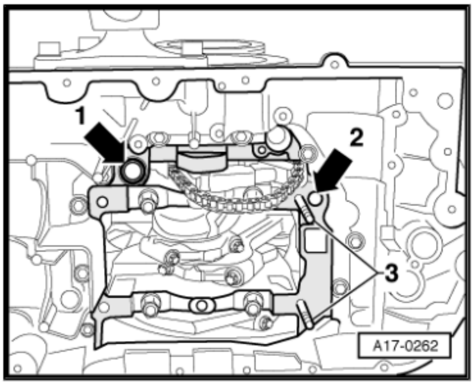
Installing

Installation is carried out in the reverse order; note the following:

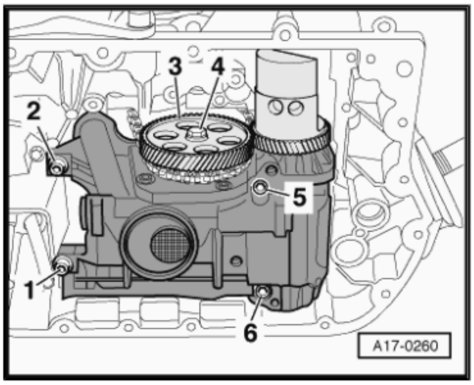
Note

Renew gaskets, seals and O-rings.

- Clean remaining locking fluid off threads of studs -3-.
- Renew O-ring -arrow 1-.
- Apply sealant around hole -arrow 2-.

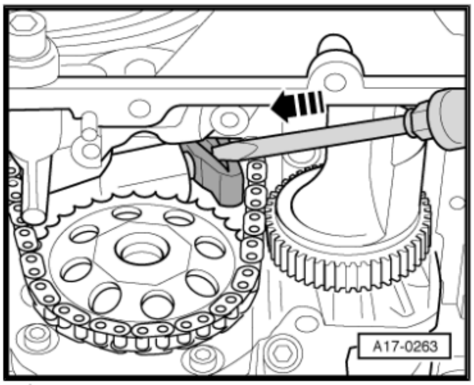


- Renew bolts -1- and -2- and nuts -5- and -6- securing oil pump.
- Apply locking fluid to nuts -5- and -6- before installing.
- Tighten all four oil pump mountings uniformly to ensure that dowel pin goes in squarely.
- Tighten mountings to final torque.
- Renew diamond-coated washer on drive gear for balance shaft -3-.
- Insert flange of drive gear (for balance shaft) through chain sprocket and onto oil pump shaft.
- Screw in bolt -4- but do not tighten.

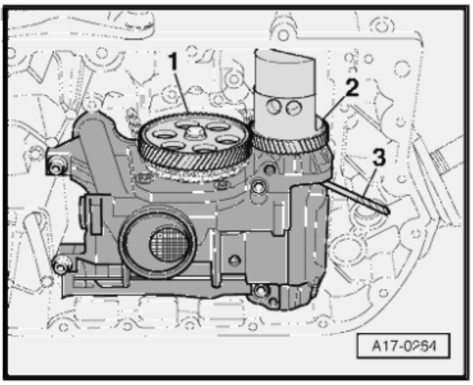


Note

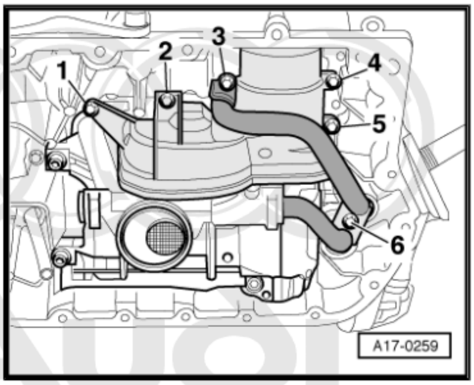
To install drive gear, press back piston of chain tensioner using a screwdriver -arrow-.



- Turn balance shaft -2- until a ∅ 5 mm pin -Item 3- (e.g. drill bit or similar) can be inserted in locating hole.
- Tighten bolt for gear -1-.
- Pull pin (drill bit) out of locating hole.
- Remove locking pin -T10026- and screw plug for TDC marking into cylinder block together with new O-ring.



- Install baffle plate (front): bolts -1-, -2-, -4- and -5-.
- Install oil pipes: bolts -3- and -6-.
- Install sump (bottom section) ⇒ page 135 .



Tightening torques

Component		Nm
Oil pump to	Nuts	20 + 120° [16] [17]
cylinder block	Bolts	22 [18]
Drive gear for balance shaft to oil pump		20 + 90° [18] [19]
Baffle plate (front) to sump (top section)		10
Oil pressure pipe to sump (top section)		10
Sealing plug in cylinder block		25

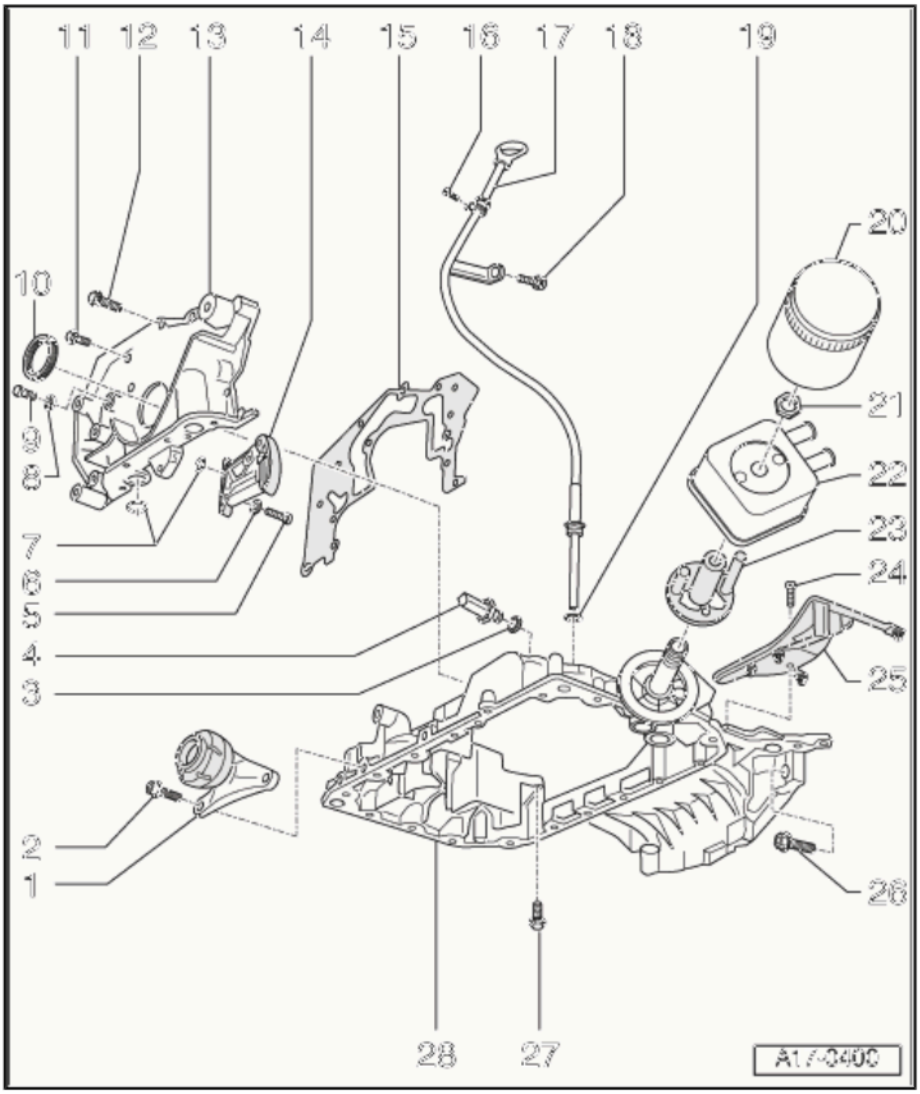
[16] 120° equals 1/3 turn.

[17] Apply locking fluid to nuts; locking fluid ⇒ Parts catalogue .

[18] Renew bolts.

[19] 90° equals a quarter of a turn.

1.4 Sump (top section), oil filter - exploded view of components



1 - Torque reaction support

2 - 40 Nm

3 - Seal
  - ☐ Renew

4 - Oil pressure switch - F1- , 1.4 bar -25 Nm-
  - ☐ Black insulation
  - ☐ Checking ⇒ page 159
  - ☐ Renew seal

5 - 12 Nm

6 - Washer

7 - O-rings
  - ☐ Renew

8 - Seal
  - ☐ Renew

9 - Screw plug -10 Nm-

10 - Oil seal
  - ☐ For crankshaft
  - ☐ Removing and installing ⇒ page 40

11 - 10 Nm

12 - 30 Nm
  - ☐ Self-locking
  - ☐ Renew

13 - Sealing flange (front)
  - ☐ Removing and installing ⇒ page 42

14 - Chain tensioner
- ☐ Removing and installing ⇒ page 156
- ☐ Insert ∅ 3 mm drill bit to hold in position

15 - Gasket
- ☐ Renew

16 - Panel bolt

17 - Guide tube for oil dipstick

18 - 10 Nm

19 - O-ring
- ☐ Renew

20 - Oil filter
- ☐ Observe change intervals ⇒ Maintenance ; Booklet 4E
- ☐ Loosen with oil filter wrench -3417-
- ☐ Observe installation instructions on oil filter
- ☐ Tighten to 20 Nm

21 - 30 Nm

22 - Oil cooler
- ☐ See note ⇒ page 134

23 - Guide piece
- ☐ With seal
- ☐ Renew

24 - 10 Nm
- ☐ Self-locking
- ☐ Renew

25 - Baffle plate (top)

26 - 45 Nm

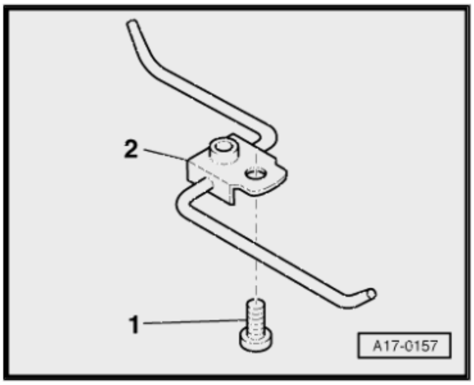
27 - M7 = 16 Nm M8 = 22 Nm

28 - Sump (top section)
- ☐ Removing and installing ⇒ page 145

Oil spray jet for piston cooling

1 - Bolt -10 Nm-

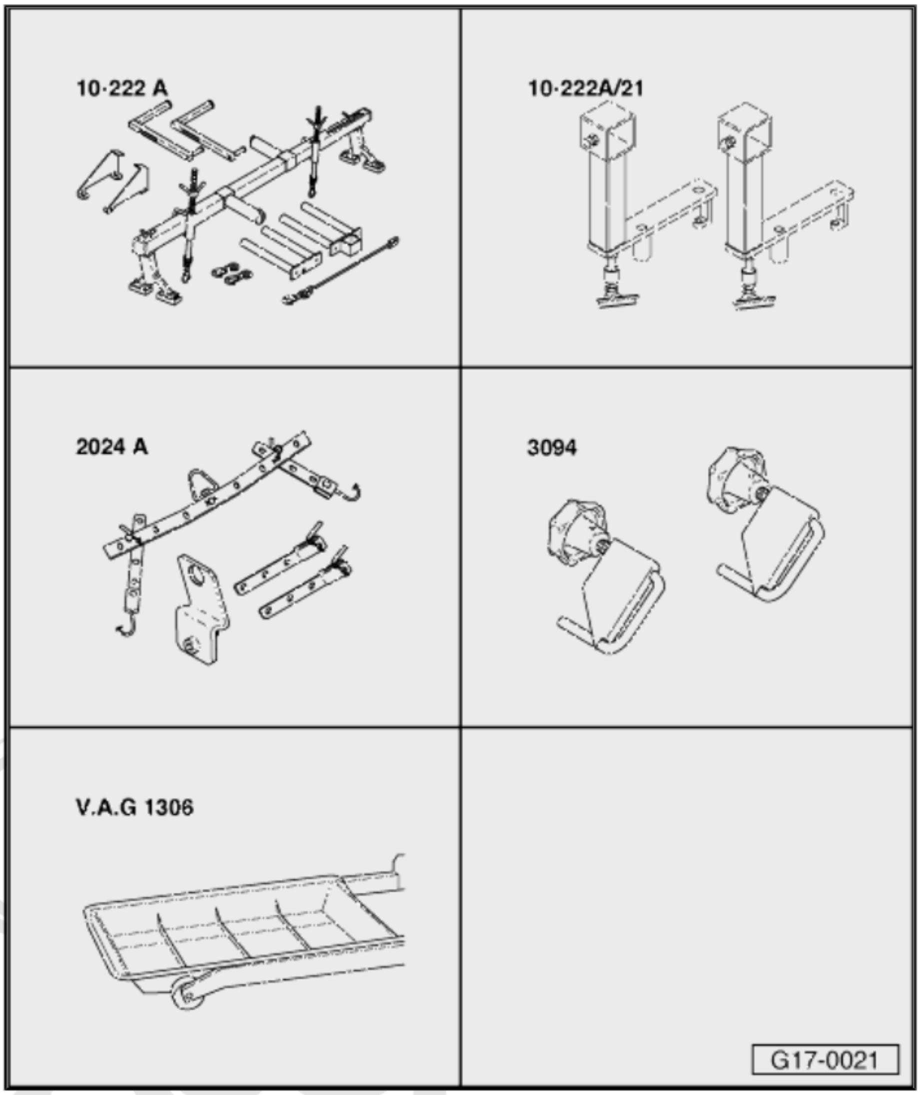
2 - Oil spray jet for piston cooling



1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

- Support bracket -10-222 A-
- Support -10-222 A/21-
- Lifting tackle -2024 A-
- Hose clamps for hoses up to 25 mm Ø -3094-
- Drip tray -V.A.G 1306-
- Drip tray
- Electric drill with plastic brush attachment
- Safety goggles
- Silicone sealant ⇒ Parts catalogue



Removing

Note

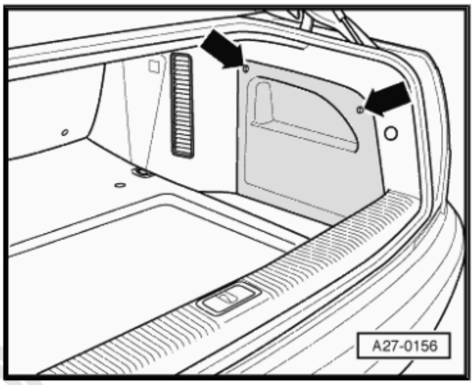
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

> WARNING
>
> *Observe notes on procedure for disconnecting the battery ⇒ Electrical system; Rep. Gr. 27 .*

– Switch off ignition.

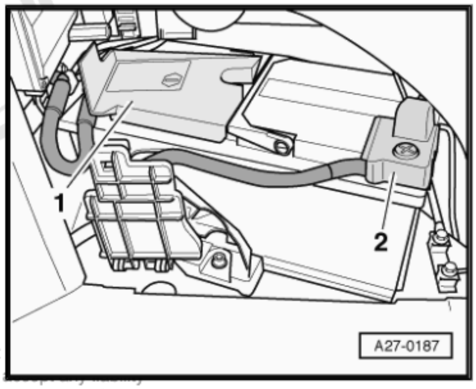
– Remove luggage compartment side trim cover (right-side) -arrows-.



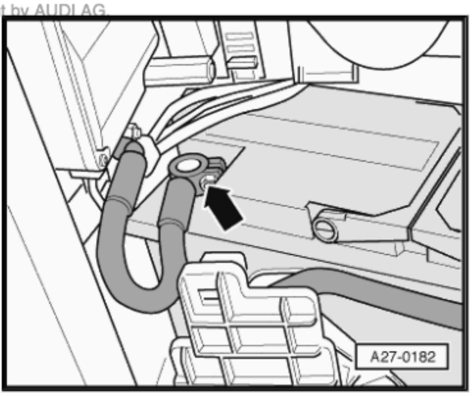
– Remove cover -1- over battery.

Note

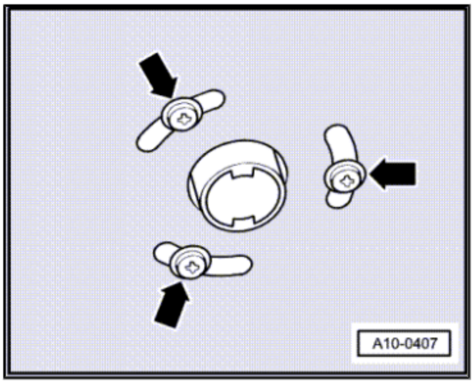
Ignore item marked -2-.



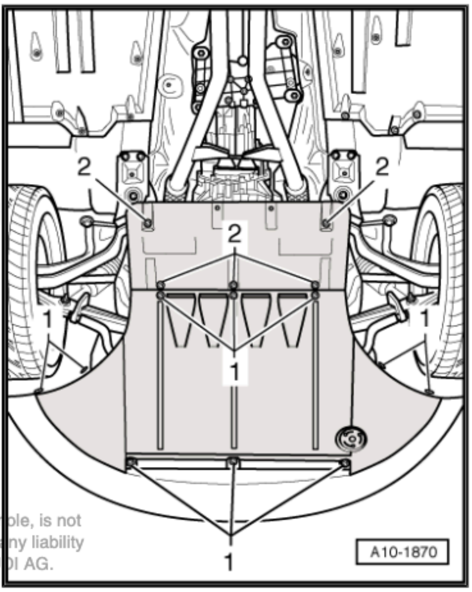
– Disconnect earth cable -arrow- at battery.



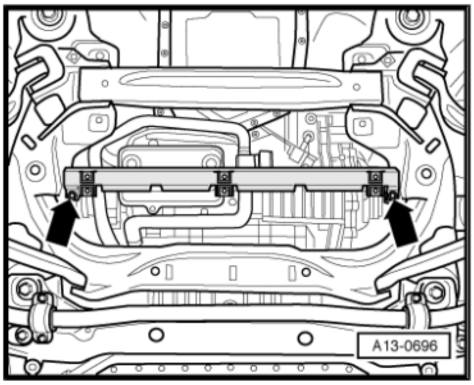
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



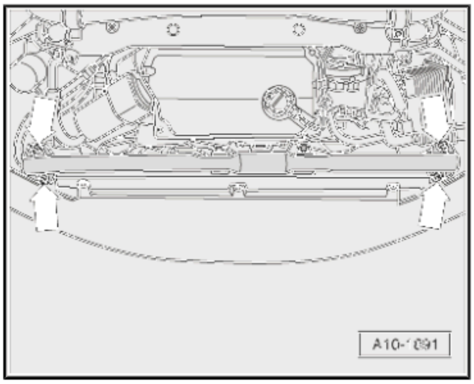
- Loosen quick release fasteners -1- and -2- and remove noise insulation parts.



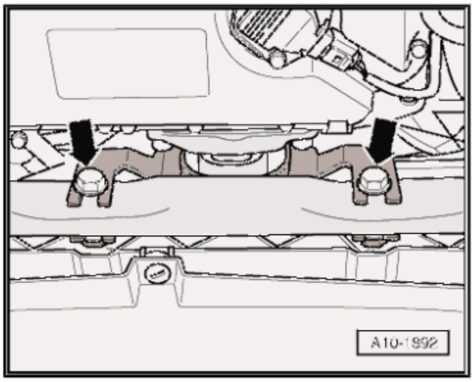
- Unbolt bracket for noise insulation -arrows-.



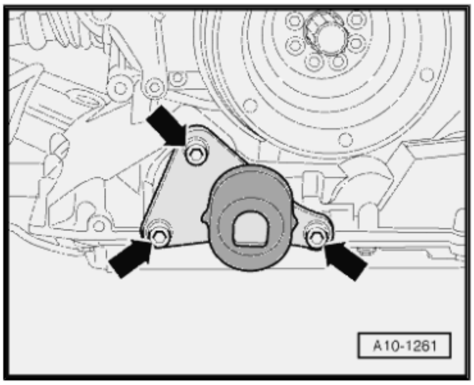
- Unbolt cross piece at lock carrier -arrows-.



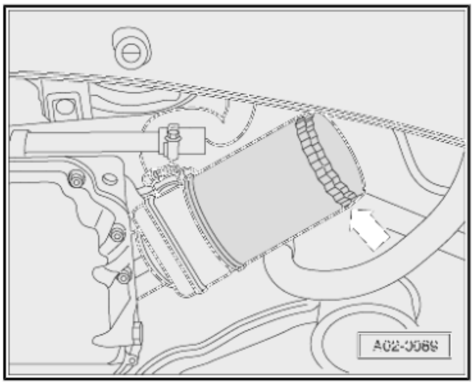
- Unbolt cross piece at stop for torque reaction support -arrows- and remove.



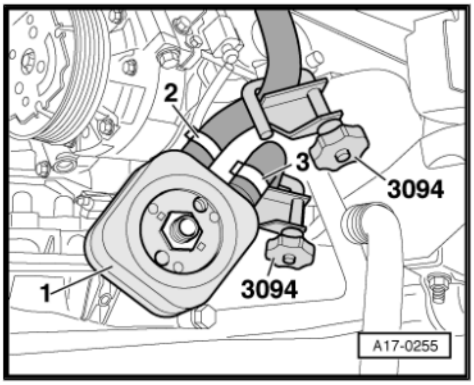
- Unscrew torque reaction support -arrows- and remove together with stop for torque reaction support.



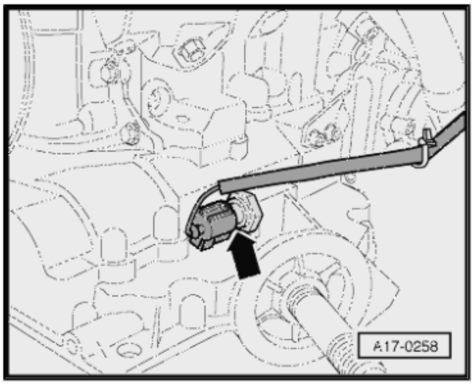
- Place drip tray below engine.
- Drain engine oil.
- Loosen oil filter -arrow-.



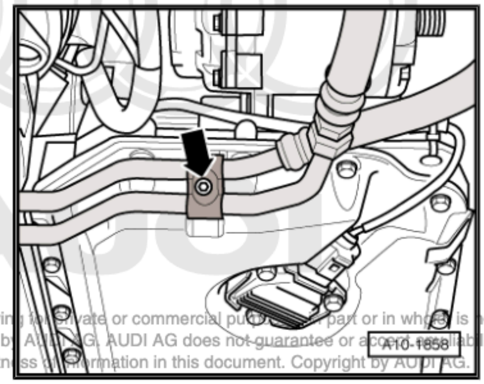
- Place container -V.A.G 1306- under engine.
- Clamp off coolant hoses -2- and -3- using hose clamps -3094- .
- Disconnect coolant hoses from oil cooler -1-.
- Remove oil cooler.



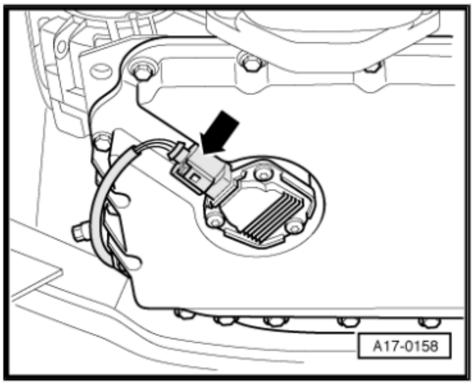
- Unplug electrical connector -arrow- at oil pressure switch -F1- .



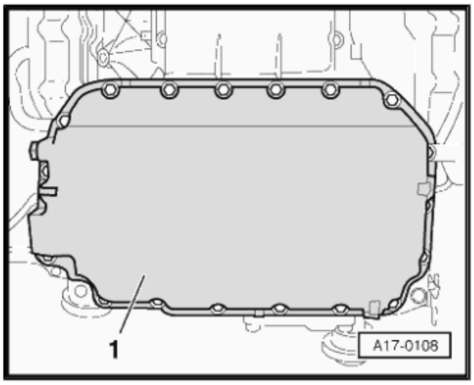
- Unscrew bracket for ATF line (right-side) at bottom section of sump -arrow-.



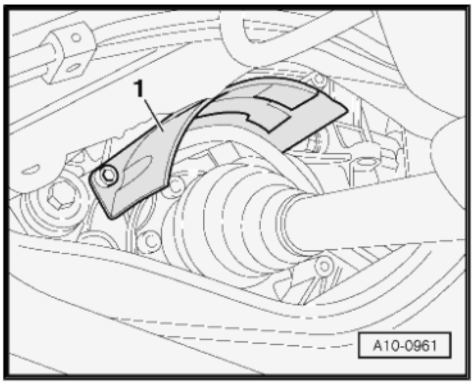
- Unplug electrical connector -arrow- at oil level/oil temperature sender -G266- and move wire clear.
- Place drip tray below engine.



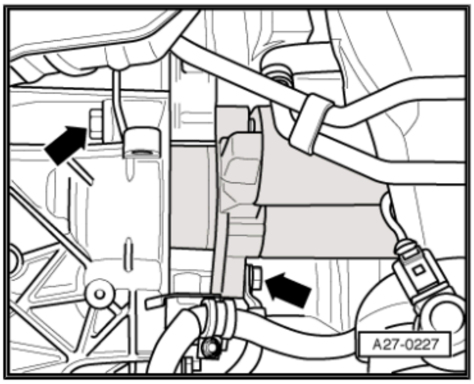
- Unbolt sump (bottom section) -1- and carefully remove.
- Remove oil pump ⇒ page 138 .



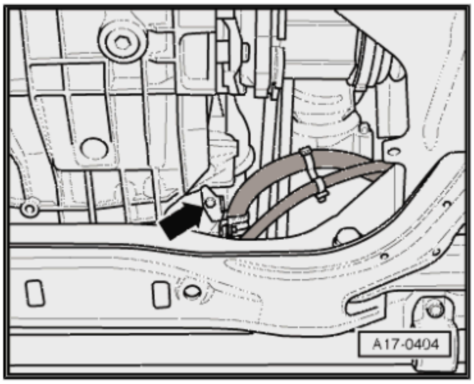
- Unbolt heat shield -1- for drive shaft (right-side) from gearbox.



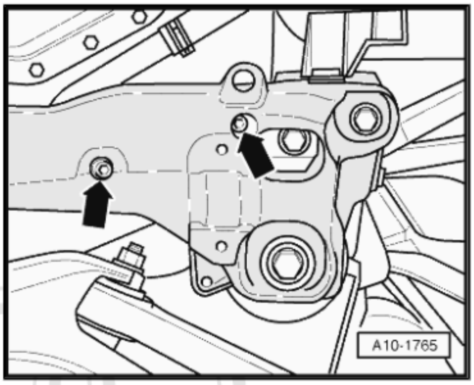
- Unscrew securing bolts -arrows- for starter, push starter forwards and tie up to side.



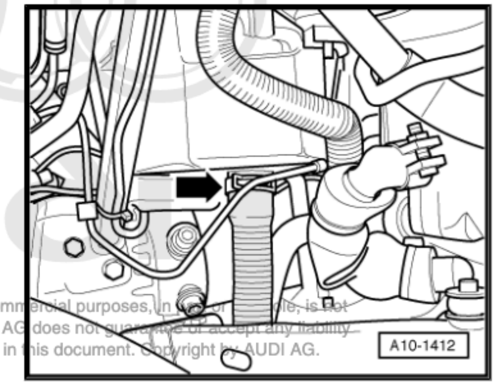
- Unscrew bolt -arrow- and remove bracket for wiring harness from sump (top section).
- Move wiring harness at sump (top section) clear.



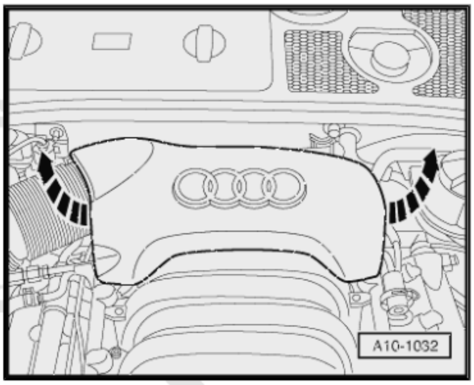
- Remove bolts -arrows- for engine mounting (left and right-side)



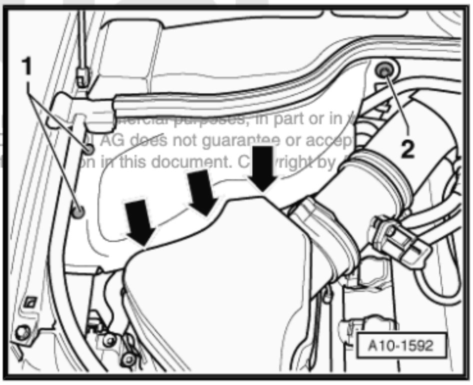
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



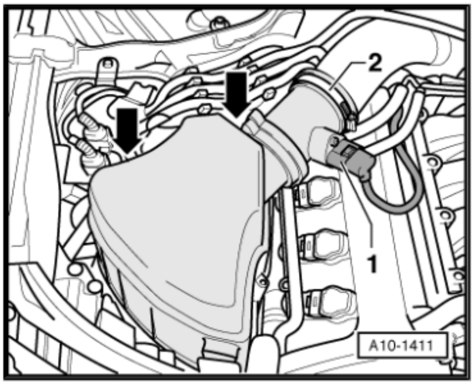
- Pull off rear engine cover -arrows-.



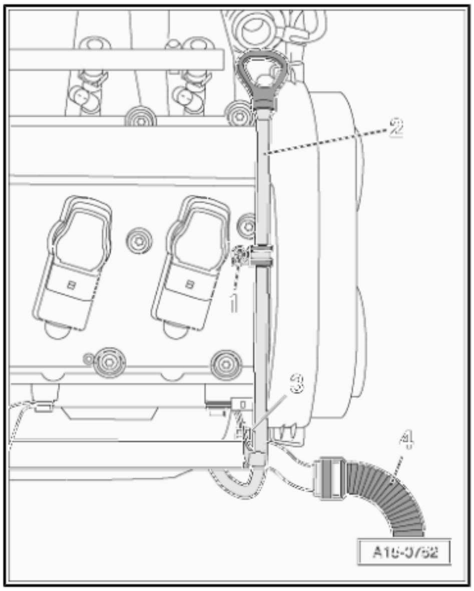
- Remove cover for suspension turret (right-side); to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



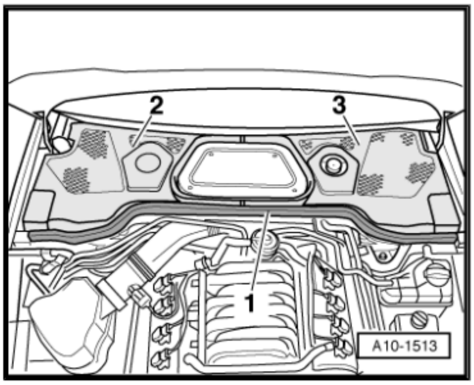
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



- Unscrew bolts -1- and -3-.
- Disconnect hose -4- at pipe for secondary air.
- Pull guide tube -2- for oil dipstick upwards out of top section of sump and fold forwards.



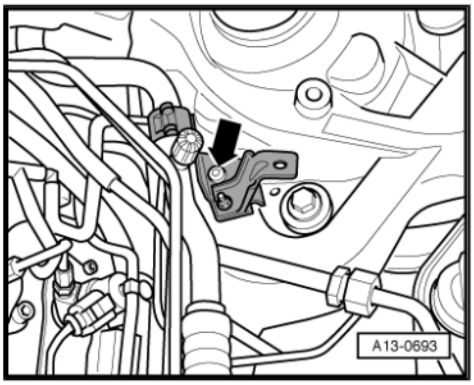
- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.
- Remove cover for suspension turret (left-side); to do so, detach spreader clip -2- and unscrew nuts -1-.



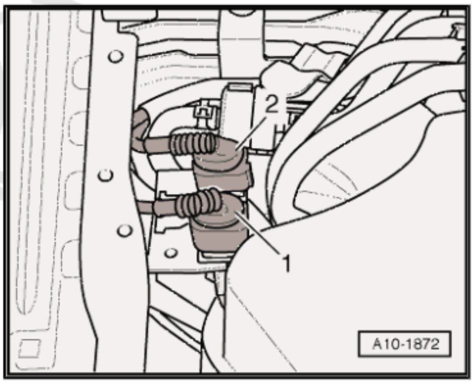
- Unscrew bolt -arrow- and move bracket for refrigerant line to side.

Note

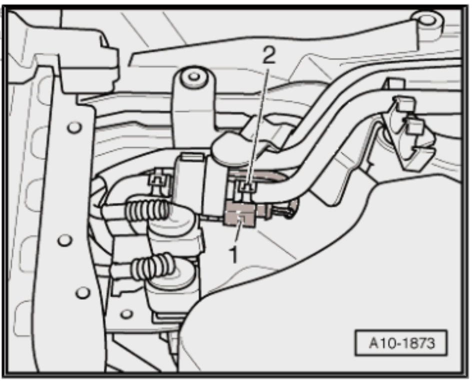
To prevent damage to the refrigerant lines, ensure that the pipes and hoses are not stretched, kinked or bent.



- Detach electrical connectors -1-and -2- from bracket and unplug.



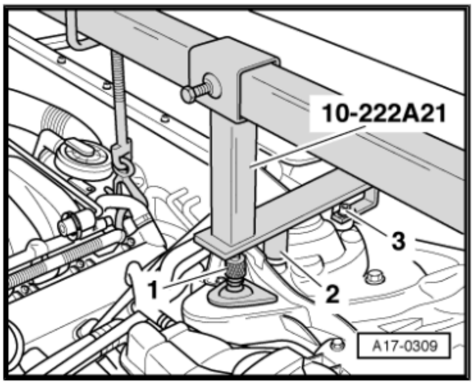
- Disconnect electrical connector -1- at solenoid valve 1 for activated charcoal filter system -N80-.
- Move wiring harness clear.
- Disconnect hose -2- at solenoid valve 1 for activated charcoal filter system -N80- and move clear.



– Unscrew rear bolts -3- for body brace.

– Attach the support bracket -10-222 A- with supports -10-222 A/21- onto the suspension turrets.

- The spindle of support bracket is located at front.
- Supports are marked for left and right-side of vehicle.
- The centre resting point -2- of supports is positioned on front bolts for body brace.
- The supports -10-222 A/21- are attached to the rear securing bolts -3- for body brace.
- The knurled screws -1- must be screwed far enough down so that support plate rests on suspension turret.

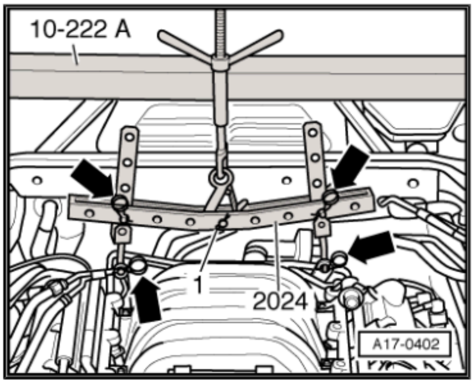


– Remove eyelets of lifting tackle -2024 A- .

– Reinsert pin -1- in centre hole in lifting tackle and secure with split pin.

– Hang the pin of lifting tackle -2024 A- onto the spindle of support bracket -10-222 A- .

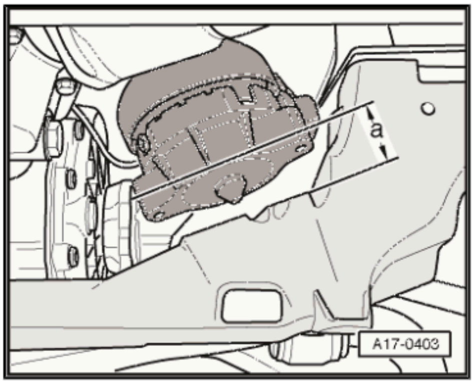
– Engage lifting tackle -2024 A- in lifting eyes (left and right-side) on engine.



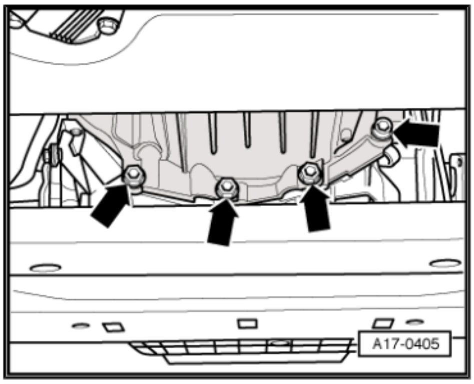
WARNING

The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.

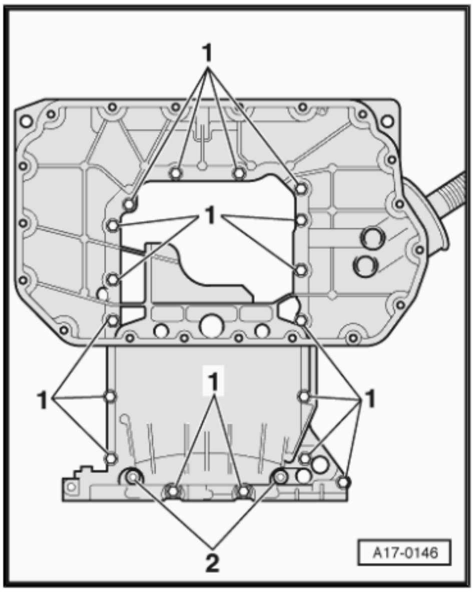
– Raise engine with spindle of support bracket -10-222 A- until the engine mountings are -a- = 35 mm over the engine supports.



– Unscrew bolts -arrows- securing engine to gearbox near sump (top section).



- Unscrew bolts -1- and -2- for sump (top section).
- Press sump (top section) off spring pins on cylinder block.
- Lower sump (top section), move to left and remove towards front.

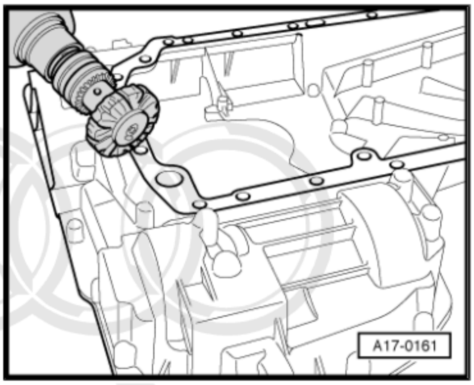


Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, seals and O-rings.*
- *All cable ties which are released or cut open when removing must be fitted in the same position when installing.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

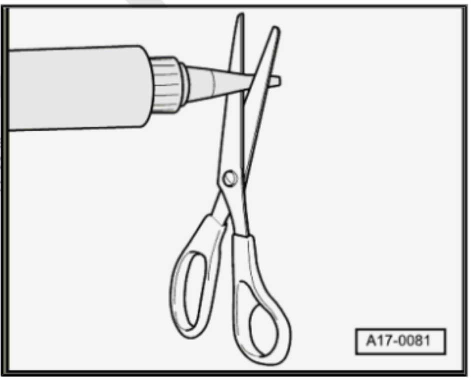


- Remove remaining sealant on sump (top section) and cylinder block using rotating plastic brush or similar.

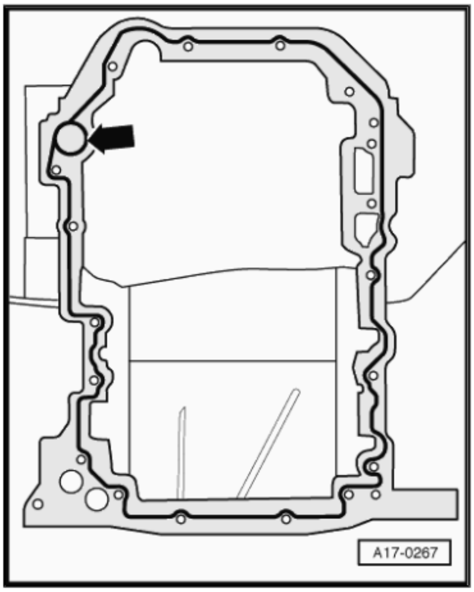
WARNING

Wear safety goggles.

- Clean sealing surfaces; they must be free of oil and grease.



- Cut off nozzle of tube at front marking (∅ of nozzle approx. 1 mm).



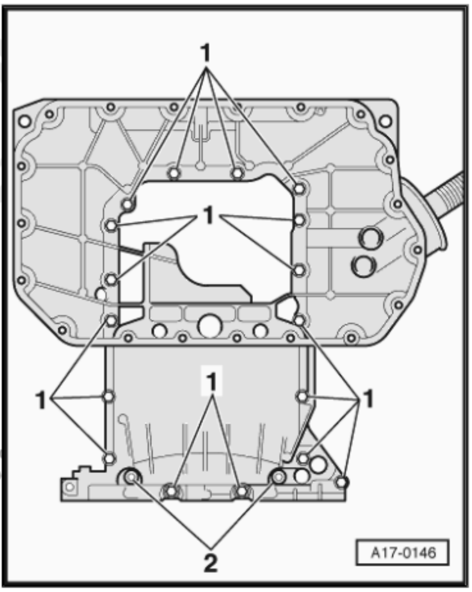
- Apply bead of silicone sealant onto the clean sealing surface of sump (top section) as illustrated.
- Bead of sealant should be approx 1.5 mm wide -arrows-.

Note

- *The sealant bead must not be thicker than specified, otherwise excess sealant could enter the sump and clog the strainer in the oil pump.*
- *Apply sealant with particular care around hole -arrow- in cylinder block.*
- *The sump (top section) must be installed within 5 minutes after applying the silicone sealant.*

- Fit sump (top section) and tighten all bolts securing sump (top section) to cylinder block initially to 5 Nm in diagonal sequence.
- Tighten bolts securing sump (top section) to gearbox to 45 Nm.

- Tighten bolts -1- to 16 Nm and bolts -2- to 22 Nm in a diagonal sequence.
- Install oil pump ⇒ page 138 .
- Install sump (bottom section) ⇒ page 135 .
- Renew O-ring on guide tube for oil dipstick and insert guide tube into hole in top section of sump.
- Install starter ⇒ Electrical system; Rep. Gr. 27
- Fill up with engine oil and check oil level ⇒ page 161 .
- Connect battery. Procedures required ⇒ Electrical system; Rep. Gr. 27 .
- Fill cooling system ⇒ page 165 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .



Tightening torques

Component		Nm
Sump (top section) to	M7	16
cylinder block and sealing flanges	M8	22
Top section of sump to gearbox		45
Bracket for refrigerant lines to suspension turret		10
Engine lifting eye to cylinder head		22
Resonator to cylinder head		10
Secondary air pipe	M6	10
to cylinder head	M8	22
Secondary air pipe to combination valve		10
Guide tube for oil dipstick to secondary air pipe		10
Air duct to throttle valve module -J338-		10
Retaining plate for	Intake manifold	10
solenoid valves to	Air duct	10
Engine mounting to engine support		23
Heat shield to gearbox		22
Oil cooler to sump (top section)		30
Torque reaction support to engine		40
Cross piece to stop for torque reaction support		65
Cross piece to body		42

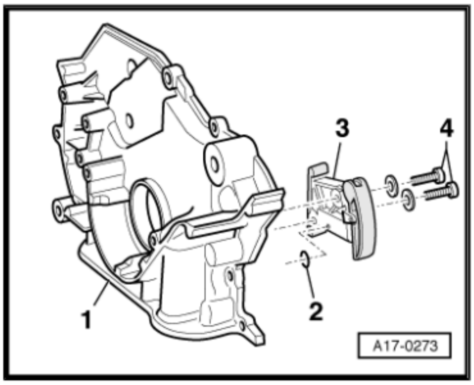
1.6 Removing and installing drive chain and chain tensioner for oil pump

Removing

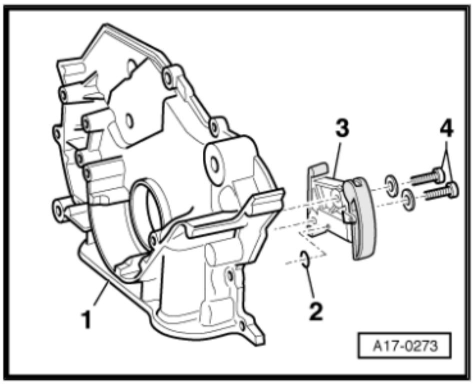
- Remove top section of sump ⇒ page 145 .
- Remove sealing flange (front) ⇒ page 42 .

- Remove bolts -4- and detach chain tensioner -3- from front sealing flange -1-.
- Take chain off drive sprocket.

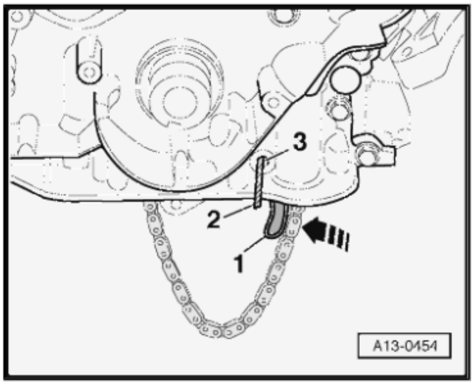
Installing



- Fit new O-ring -2-.
- Install chain tensioner -3- with bolts -4- (and washers) on front sealing flange -1-.



- Unscrew plug from access hole -3-.
- Press chain tensioner -1- in direction of arrow until a ∅ 3 mm drill bit -2- can be inserted into locating holes in sealing flange and chain tensioner.
- Install sealing flange (front) ⇒ page 42 .
- Install sump (top section) ⇒ page 145 .



Tightening torque

Component	Nm
Chain tensioner to sealing flange (front)	12

1.7 Oil retention valve and spray nozzle valve - exploded view of components

Note

In the event of irregular valve noise which disappears after a lengthy drive but repeatedly re-occurs when travelling short distances, the oil retention valves must be renewed.

1 - O-rings
- ☐ Renew

2 - Oil retention valve -20 Nm-
- ☐ For oil supply to cylinder head (left-side)

3 - Banjo bolt -15 Nm-

4 - Baffle plate

5 - Gasket
- ☐ Renew

6 - Cover
- ☐ With connection for crankcase breather
- ☐ To remove, see Removing and installing intake manifold ⇒ page 94

7 - 10 Nm

8 - Hose
- ☐ To pressure control valve for crankcase breather

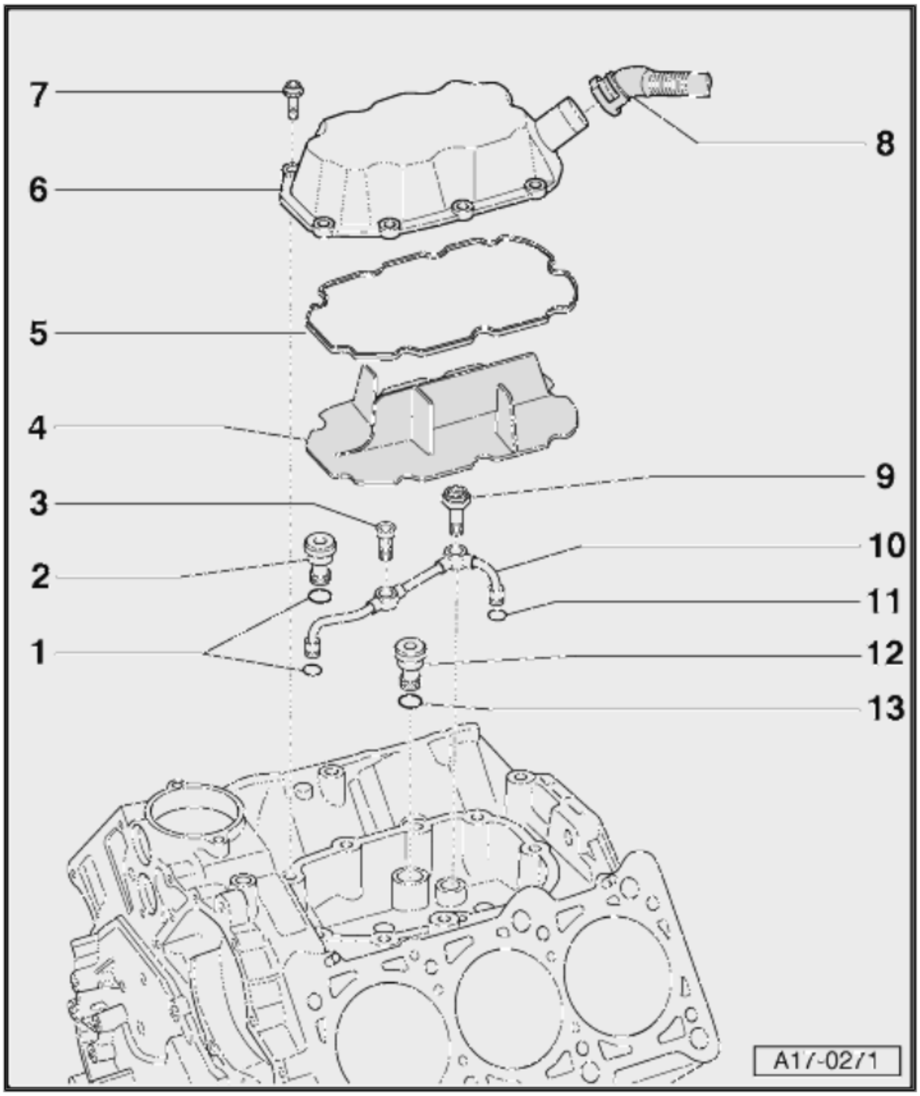
9 - Spray nozzle valve -25 Nm-
- ☐ For piston cooling

10 - Oil pipe
- ☐ Renew

11 - O-ring

12 - Oil retention valve -20 Nm-
- ☐ For oil supply to cylinder head (right-side)

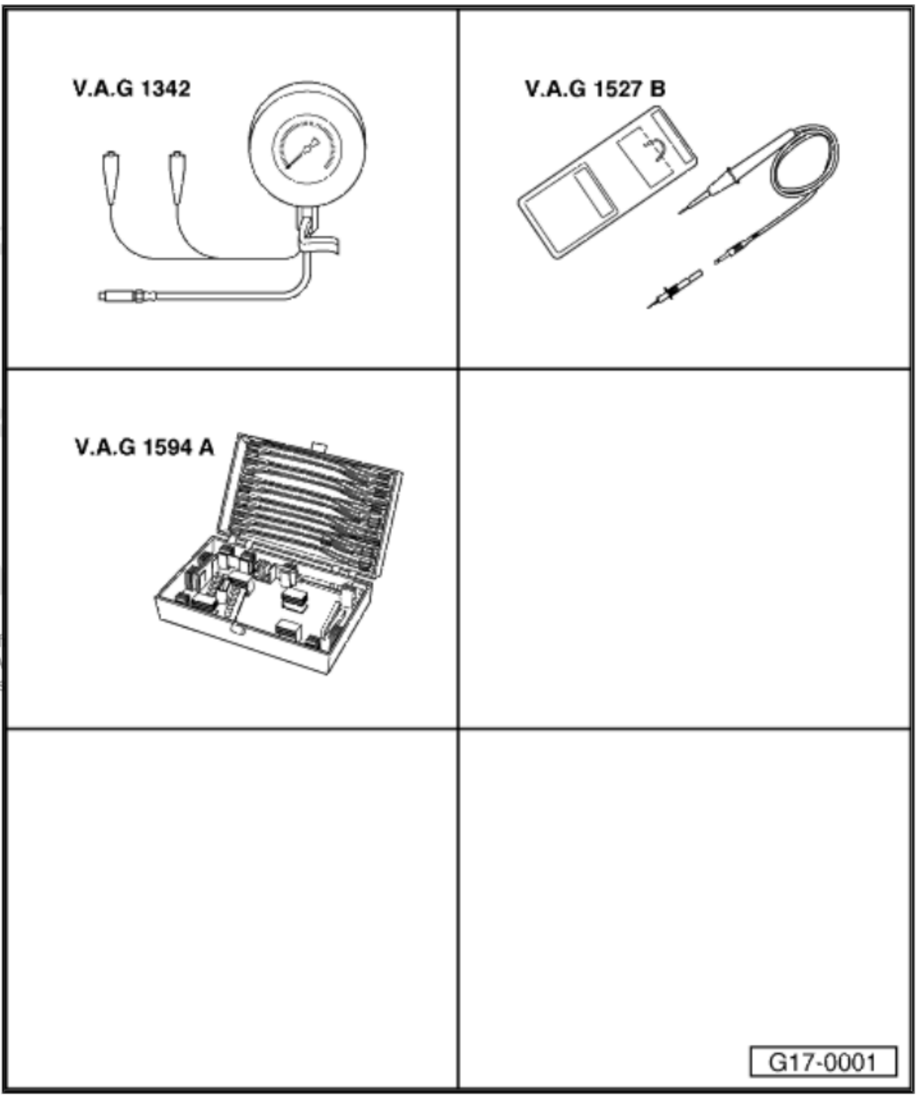
13 - O-ring
- ☐ Renew



1.8 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- Oil pressure tester -V.A.G 1342-
- Voltage tester -V.A.G 1527 B-
- Adapter set -V.A.G 1594 A-

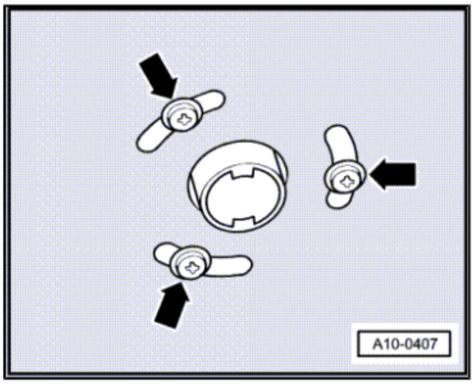


Test conditions

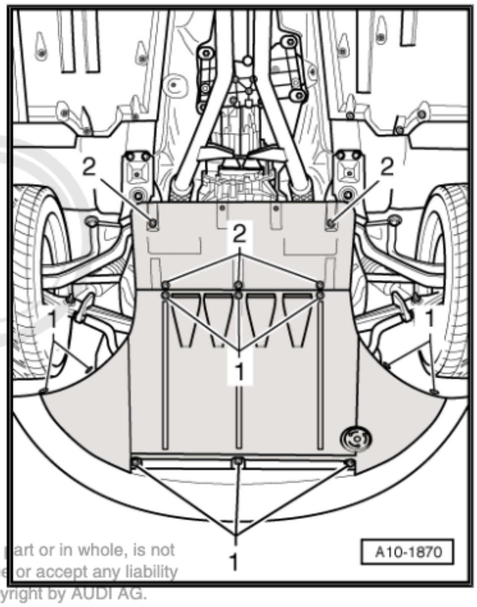
- Oil level OK.
- Engine oil temperature approx. 80°C.

Preparation for test

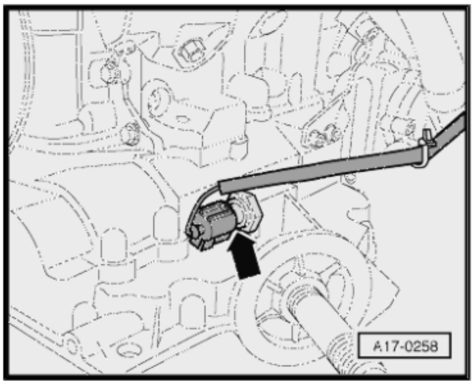
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



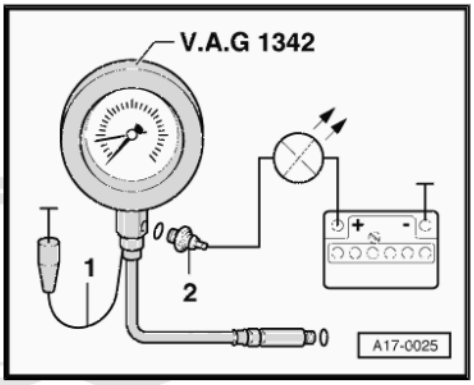
- Loosen quick release fasteners -1- and remove front noise insulation.



- Unplug electrical connector -arrow- at oil pressure switch.
- Unscrew oil pressure switch.



- Connect oil pressure tester -V.A.G 1342- to threaded hole for oil pressure switch.
- Screw oil pressure switch -2- into oil pressure tester -V.A.G 1342- .



Checking oil pressure switch

- Connect brown wire -1- of oil pressure tester to earth (-).
- Connect voltage tester -V.A.G 1527 B- with test leads from adapter set -V.A.G 1594 A- to oil pressure switch and battery positive (+).

- LED should not light up.

If the LED is lit:

- Renew oil pressure switch.
- Start the engine.

Note

Observe tester and LED while starting, as switching point of oil pressure switch may already be exceeded when starting.

- Test lamp should light up at 1.2 ... 1.6 bar.

If the LED does not light up:

- Renew oil pressure switch.

Checking oil pressure

- Start the engine.

- Minimum oil pressure at idling speed: 1.5 bar
- Minimum oil pressure at 2000 rpm: 3.0 bar

Assembling

Assembly is carried out in the reverse order; note the following:

- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

Tightening torque

Component	Nm
Oil pressure switch to sump (top section)	25

1.9 Engine oil

Viscosity grades and oil specifications ⇒ Maintenance ; Booklet 4E .

1.10 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 4E .

19 – Cooling

1 Cooling system - on engine

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

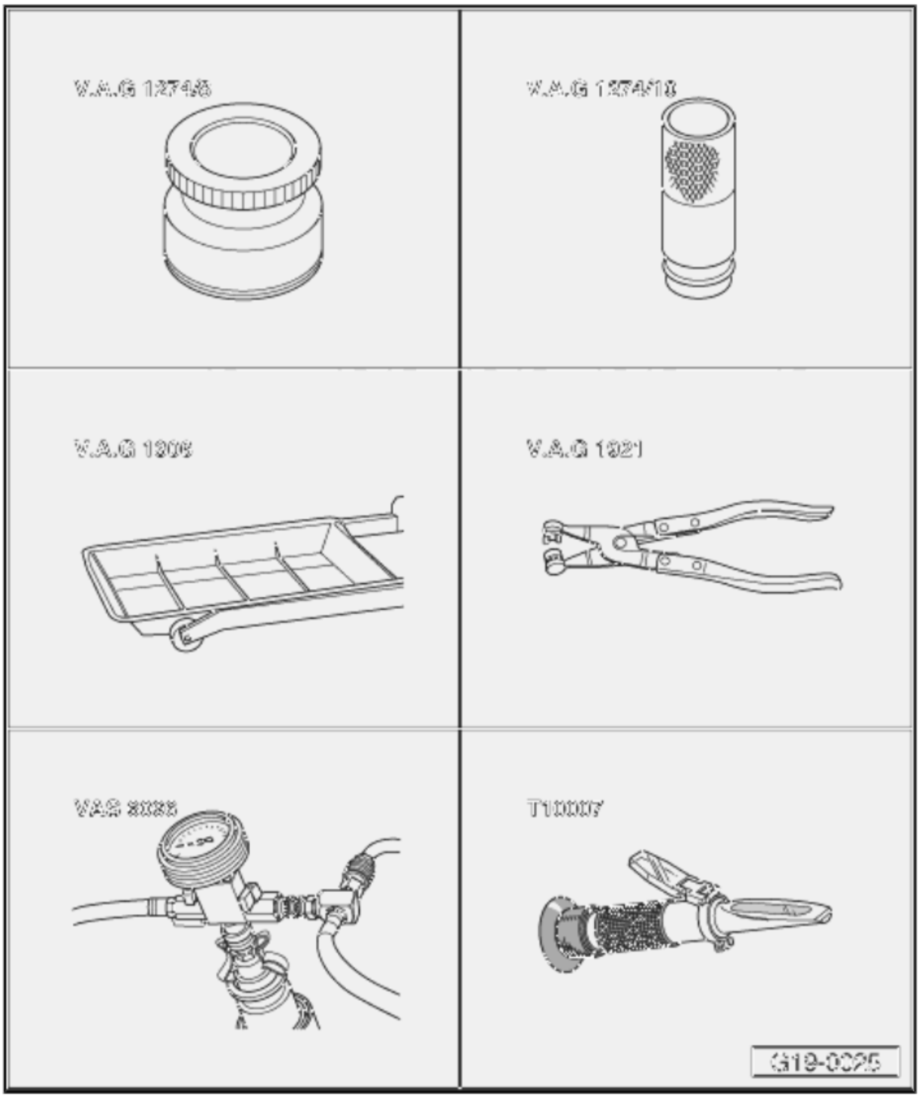
Note

- *When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Renew seals and gaskets.*
- *The arrow markings on coolant pipes and on ends of hoses must align.*

1.1 Draining and filling cooling system

Special tools and workshop equipment required

- Adapter -V.A.G 1274/8-
- Pipe -V.A.G 1274/10-
- Drip tray -V.A.G 1306-
- Hose clip pliers -V.A.G 1921-
- Cooling system filler unit -VAS 6096-
- Refractometer -T10007-



Draining

Note

Collect drained coolant in a clean container for re-use or disposal.

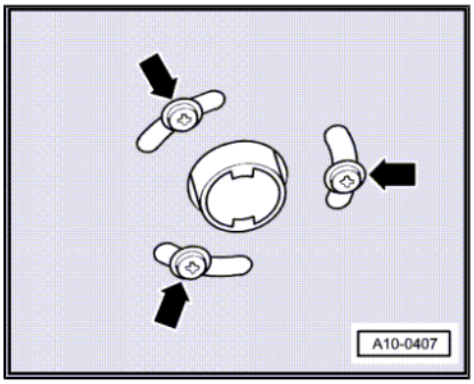
– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

WARNING

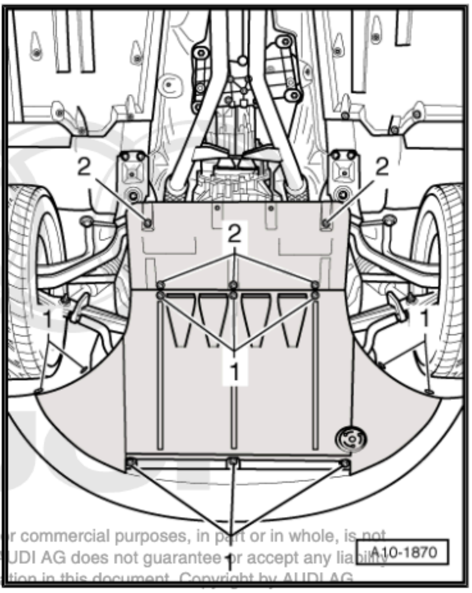
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

– Open filler cap on coolant expansion tank.

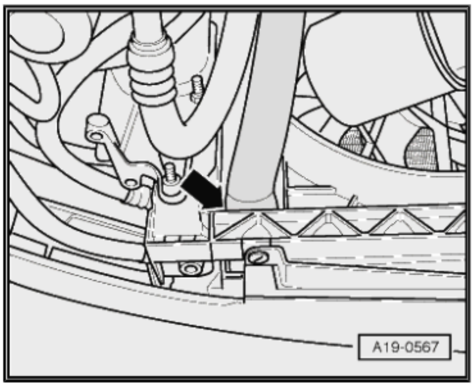
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



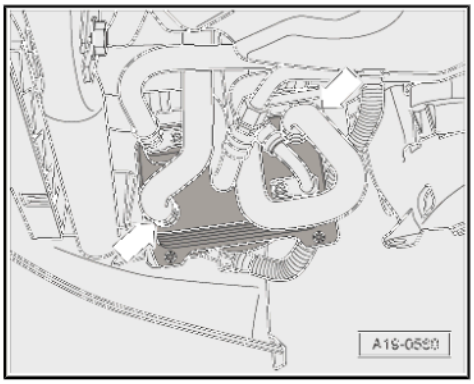
- Loosen quick release fasteners -1- and remove front noise insulation.



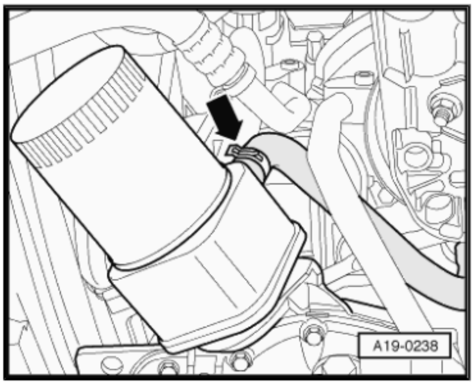
- Place drip tray -V.A.G 1306- under engine.
- Detach coolant hose from bottom left of radiator -arrow- and drain off coolant.



- Disconnect coolant hoses -arrows- from ATF cooler and drain off coolant.



– Also detach coolant hose from oil cooler -arrow-, and drain off remaining coolant.



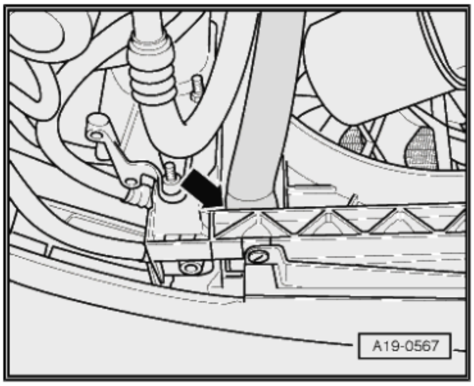
Filling

Note

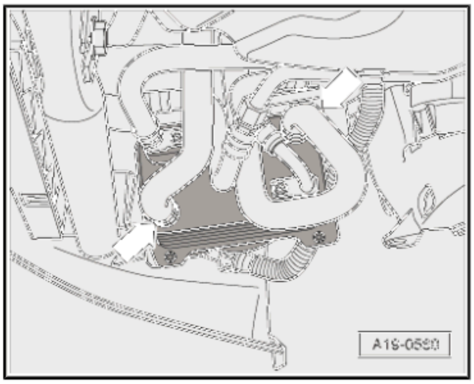
- ♦ *The cooling system is filled all year round with a mixture of water and antifreeze/corrosion protection agent.*
- ♦ *It is important to use only coolant additive Plus -G 012 A8F A1- (also designated as “G12+”) “meeting specification TL VW 774 F”. Other coolant additives could seriously impair in particular the anticorrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
- ♦ *Coolant additive “G12+” may be mixed with additives “G11” and “G12”.*
- ♦ *“G12+” and coolant additives marked “Conforming with specification TL VW 774 F” prevent frost and corrosion damage and stop scale from forming. Such additives also raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct antifreeze and anticorrosion additive.*

- ♦ *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- ♦ *Frost protection is required down to about -25°C (in countries with arctic climate: down to about -35°C).*
- ♦ *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The antifreeze percentage must be at least 40 %.*
- ♦ *If greater frost protection is required in very cold climates, the amount of “G12+” can be increased, but only up to 60% (this gives frost protection to about -40°C). If antifreeze concentration exceeds 60%, frost protection decreases again and cooling efficiency is also impaired.*
- ♦ *Only use clean drinking water for mixing coolant.*
- ♦ *If radiator, heat exchanger, cylinder head, cylinder head gasket or cylinder block have been renewed, do not re-use old coolant.*
- ♦ *Contaminated or dirty coolant must not be used again.*
- ♦ *To check frost protection level of coolant additive “G12+” you must use a refractometer -T10007- .*
- ♦ *Renew seal.*

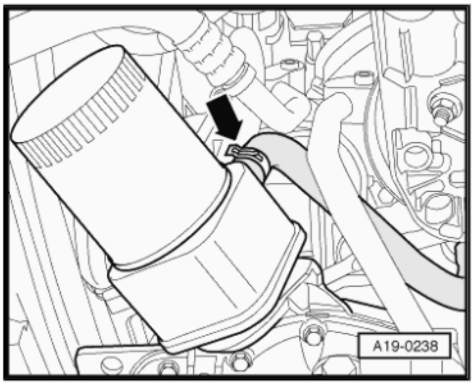
– Connect coolant hose (bottom left) to radiator -arrow-.



Connect coolant hoses to ATF cooler -arrows-.



– Connect coolant hose to oil cooler -arrow-.



– Fill reservoir -VAS 6096/1- with at least 15 litres of premixed coolant (based on recommended ratio):

- “G12+” (40 %) and water (60 %) for frost protection to -25°C
- “G12+” (50 %) and water (50 %) for frost protection to -35°C
- “G12+” (60 %) and water (40 %) for frost protection to -40°C

– Screw adapter for cooling system tester -V.A.G 1274/8- onto coolant expansion tank.

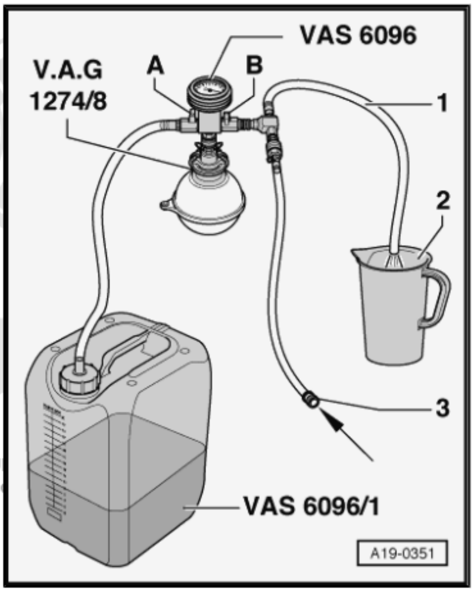
– Fit cooling system charge unit -VAS 6096- onto adapter -V.A.G 1274/8- .

– Feed vent hose -1- into a small container -2-. (The vented air draws along a small amount of coolant, which should be collected.)

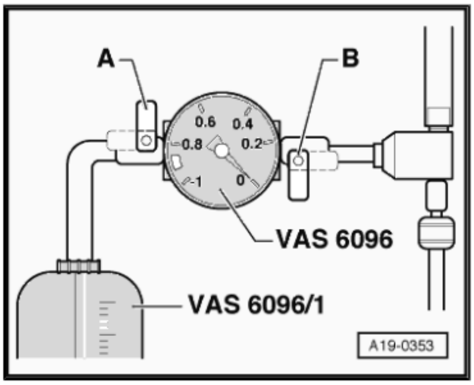
– Close the two valves -A- and -B- by setting lever at right angle to direction of flow.

– Connect hose -3- to compressed air.

- Pressure: 6 ... 10 bar.



- Open valve -B- (turn lever in direction of flow).



The suction jet pump generates a vacuum in the cooling system.

- The needle on the gauge must move into the green zone.
- Also briefly open valve -A- (turn lever in direction of flow) so that hose on coolant expansion tank -VAS 6096/1- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump will continue generating a vacuum in the cooling system.
- The needle on the gauge must remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

If the needle does not reach the green area, repeat the process.

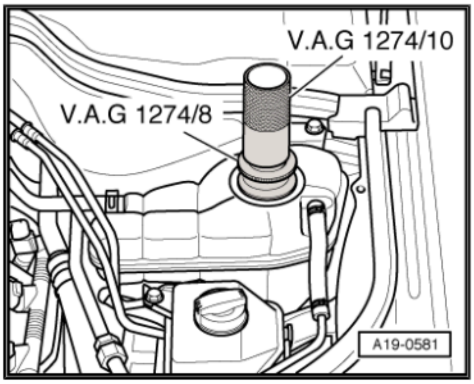
If the vacuum level drops, there is a leak in the cooling system.

- Detach the compressed air hose.
- Open valve -A-.

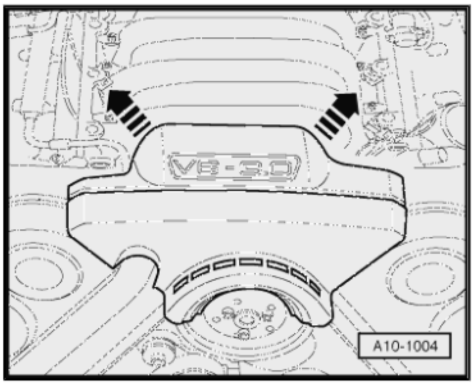
The vacuum in the cooling system causes the coolant to be drawn out of the cooling system charge unit -VAS 6096/1- ; the cooling system is then filled.

- Detach cooling system charge unit -VAS 6096- from expansion tank.

- Fit pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .



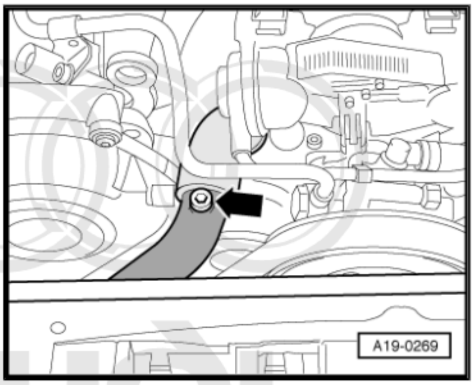
- Pull off front engine cover -arrows-.



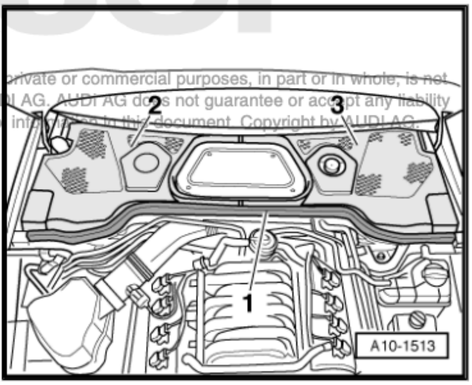
- Unscrew bleeder screw -arrow-.
- Fill up with coolant until it flows out at bleeder hole in coolant pipe.
- Tighten bleeder screw to 15 Nm.

Note

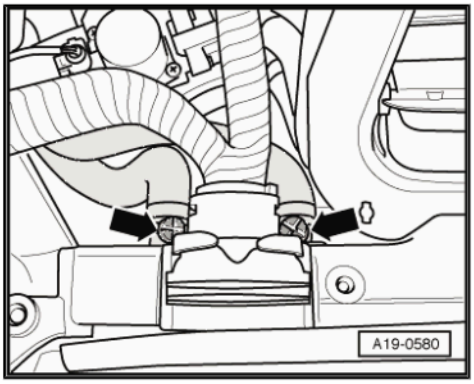
Renew seal.



- Pull off rubber seal -1- on plenum chamber covers.
- Detach plenum chamber covers -2- and -3-.



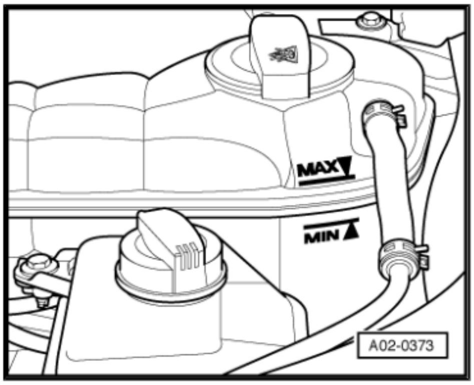
- Open bleeder screws -arrows-.
- Fill up with coolant until it flows out at bleeder holes in coolant hoses.
- Close the bleeder screws.
- Tighten filler cap on expansion tank.
- Start engine and maintain an engine speed of about 2,000 rpm for approx. 3 minutes.
- Then allow engine to run at idling speed until the lower hose on radiator becomes hot.



WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Check coolant level and top up if necessary. When the engine is at normal operating temperature, the coolant level must be on the MAX mark, when the engine is cold, between the MIN and MAX marks.
- Switch off engine.
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .



1.2 Coolant pump and thermostat - exploded view

1 - 10 Nm

2 - 10 Nm

3 - Coolant pump

- ☐ Removing and installing ⇒ page 169

4 - Gasket

- ☐ Renew

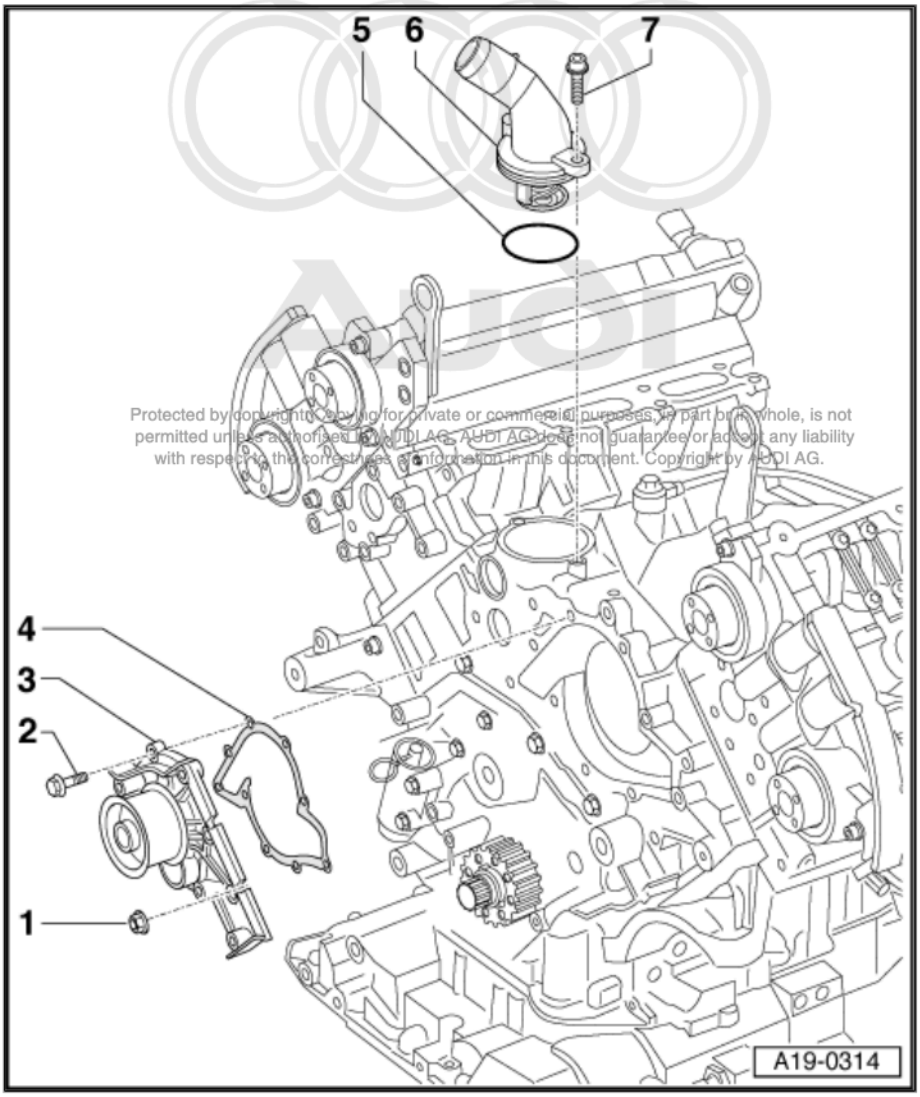
5 - O-ring

- ☐ Renew

6 - Coolant thermostat with hose flange

- ☐ Can only be renewed as complete unit
- ☐ Removing and installing ⇒ page 171
- ☐ Checking ⇒ page 173

7 - 10 Nm

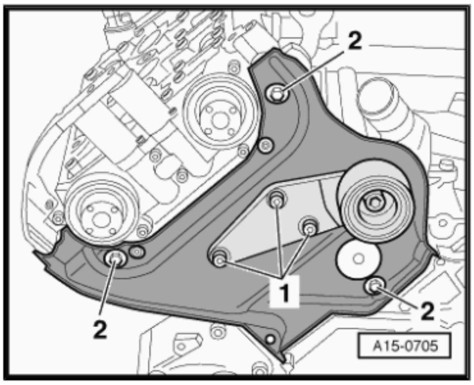


1.3 Removing and installing coolant pump

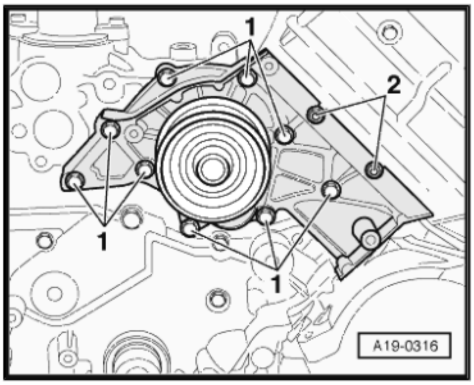
Removing

- Drain off coolant ⇒ page 163 .
- Remove power steering pump ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48 .
- Remove toothed belt ⇒ page 62 .
- Remove camshaft sprockets on cylinder head (right-side).

- Remove bolts -1- and take off bracket with idler roller.
- Remove bolts -2- and take off toothed belt guard (rear right).
- Remove eccentric adjuster for toothed belt.



- Unscrew nuts -2- securing toothed belt guard (rear left).
- Unscrew bolts -1- securing coolant pump and detach coolant pump.



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

- Install toothed belt (adjust valve timing) ⇒ page 69 .
- Install power steering pump ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48 .
- Fill cooling system ⇒ page 165 .

Tightening torques

Component	Nm
Coolant pump to cylinder block	10
Toothed belt guard (rear) to coolant pump	10
Toothed belt guard (rear right) to engine	10 [20]
Bracket for idler roller to cylinder head	10 [20]

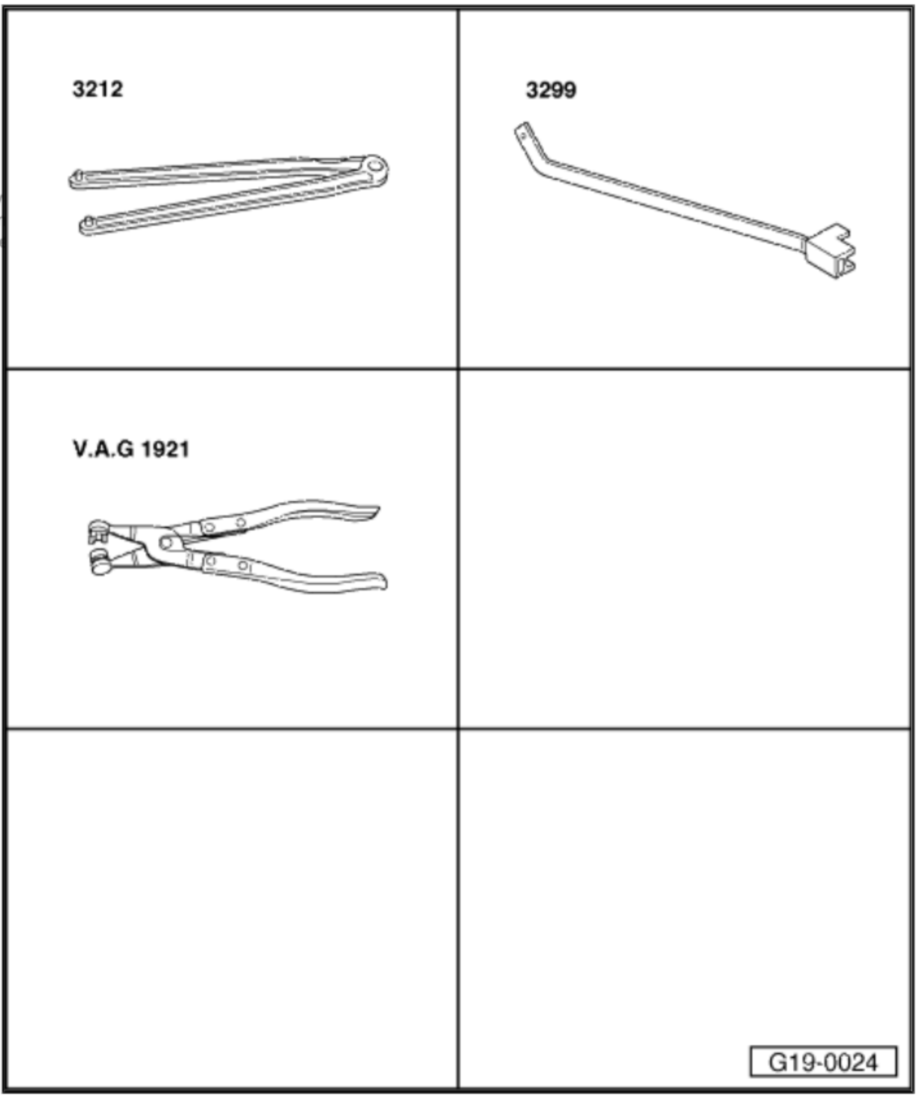
20) Renew bolt.

1.4 Removing and installing thermostat

Special tools and workshop equipment required

- 2-hole pin wrench -3212-
- Poly V-belt lever -3299- with bracket - 3299/1-
- Hose clip pliers - V.A.G 1921-

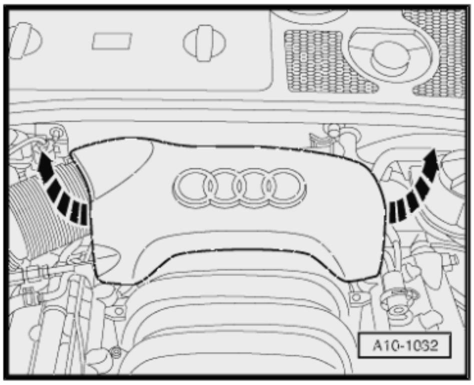
Protected by
permitted u
with resp



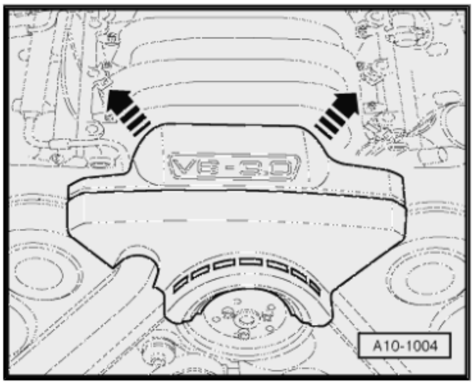
Removing

– Drain off coolant ⇒ page 163 .

– Pull off rear engine cover -arrows- ...



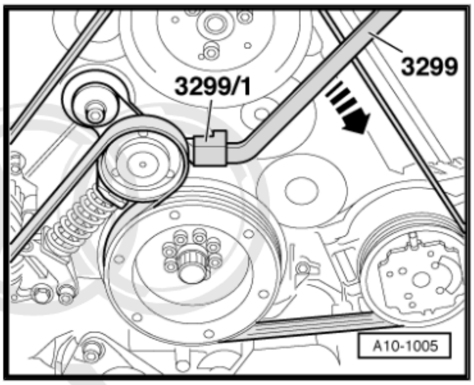
- ... as well as front engine cover -arrows-.



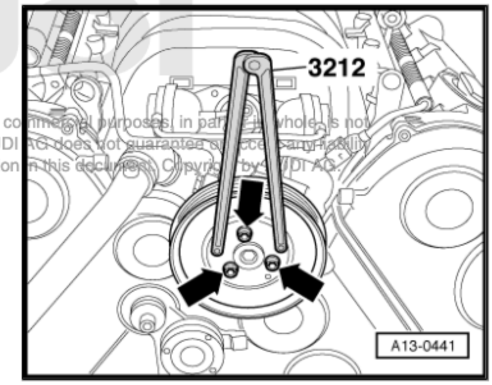
Note

Before removing, mark direction of rotation of poly V-belt with chalk or felt-tipped pen. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

- To slacken the poly V-belt, turn the tensioner in the direction indicated by the arrow, using the poly V-belt lever -3299- and -3299/1- .
- Remove poly V-belt from pulley for vane pump.



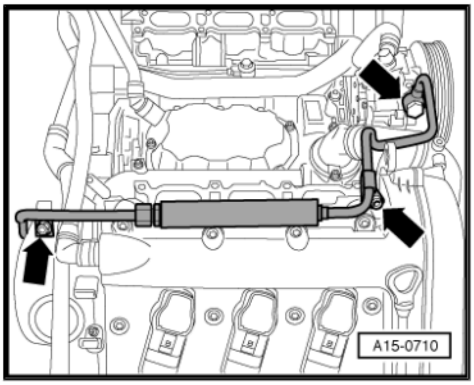
- Unbolt poly V-belt pulley at vane pump -arrows-, using 2-hole pin wrench -3212- as a counterhold.



Note

Lay a cloth under the hydraulic pressure pipe to catch any escaping hydraulic fluid.

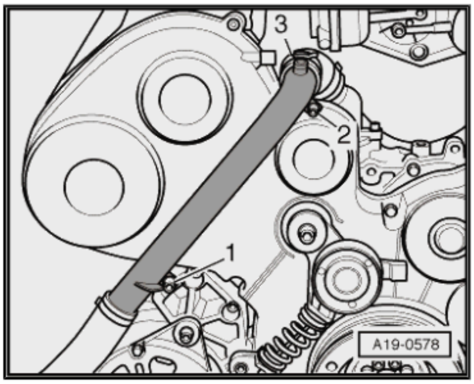
- Remove pressure pipe for power-assisted steering at vane pump, cylinder head and rear coolant pipe -arrows on right side of illustration-.



Note

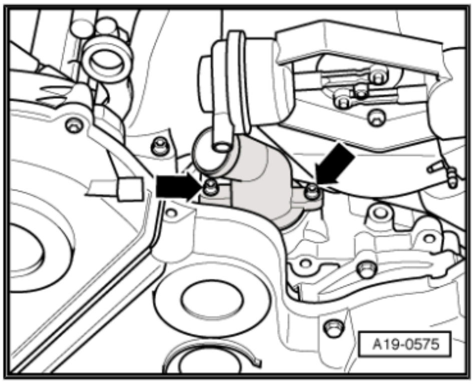
Ignore -arrow on left side of illustration-.

- Unscrew bolts -1- and -2- for coolant pipe.
- Release clip -3- and detach coolant pipe from coolant hose connection.



Note

Place a cloth underneath to catch any escaping coolant.



- Unscrew bolts -arrows-.
- Detach thermostat with hose flange.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew seals and O-ring.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*

- Before installing, clean and smoothen sealing surface for O-ring.
- Install poly V-belt ⇒ page 33 .
- Fill cooling system ⇒ page 165 .
- Top up power steering fluid and bleed steering system: ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48

Tightening torques

Component	Nm
Hose flange for thermostat to cylinder block	10
Coolant pipe to engine	10
Banjo bolt to vane pump	47
Hydraulic pipe to cylinder head	22
Pulley to vane pump	23

1.5 Checking thermostat

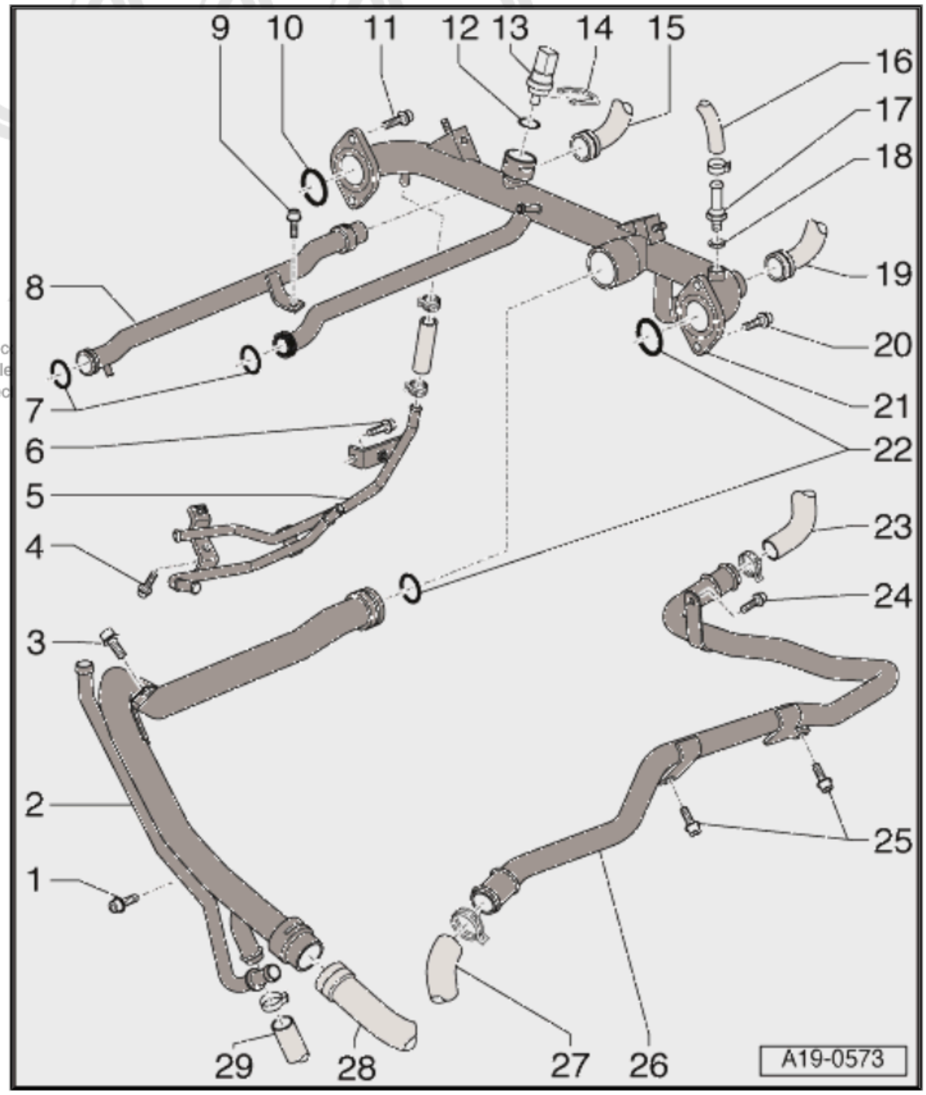
- Heat thermostat in water bath.

Starts to open	Fully open	Opening travel
approx. 87°C	approx. 102°C [21]	at least 8 mm

---

[21] Cannot be tested.

1.6 Coolant pipes - exploded view of components



1 - 10 Nm

2 - Coolant pipe (front)

- ☐ Removing and installing ⇒ page 175

3 - 22 Nm

4 - 10 Nm

5 - Coolant pipe leading to alternator

- ☐ Removing and installing ⇒ page 182

6 - 10 Nm

7 - O-rings

- ☐ Renew

8 - Coolant pipe (right-side)

- ☐ Removing and installing ⇒ page 179

9 - 10 Nm

10 - O-ring

- ☐ Renew

11 - 10 Nm

12 - O-ring

- ☐ Renew

13 - Coolant temperature sender -G2- / Coolant temperature sender -G62-

14 - Retaining clip

15 - Coolant hose

- ☐ To heating system heat exchanger

16 - Coolant hose

- ☐ To expansion tank

17 - Connection

- ☐ Tighten to 15 Nm

18 - Seal

- ☐ Renew

19 - Coolant hose

- ☐ To heating system heat exchanger

20 - 10 Nm

21 - Coolant pipe (rear)

- ☐ Removing and installing ⇒ page 180

22 - O-rings

- ☐ Renew

23 - Coolant hose

- ☐ To heating system heat exchanger

24 - 10 Nm

25 - 22 Nm

26 - Coolant pipe (left-side)

- ☐ Removing and installing ⇒ page 176

27 - Coolant hose

- ☐ To expansion tank

28 - Coolant hose

- ☐ To bottom of radiator

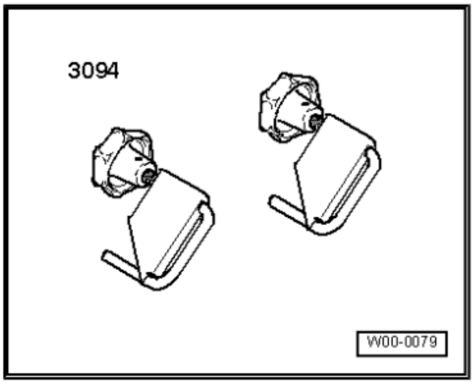
29 - Coolant hose

- ☐ To oil cooler

1.7 Removing and installing coolant pipe (front)

Special tools and workshop equipment required

- ♦ Hose clamps for hoses up to 25 mm Ø -3094-



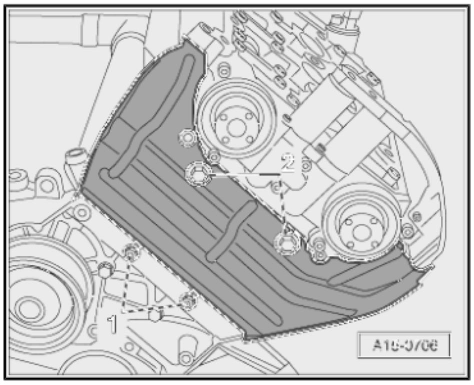
- ♦ Drip tray

Removing

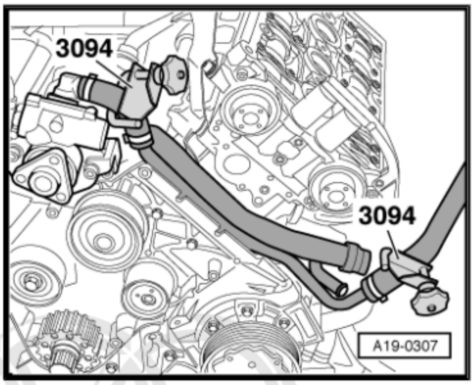
Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

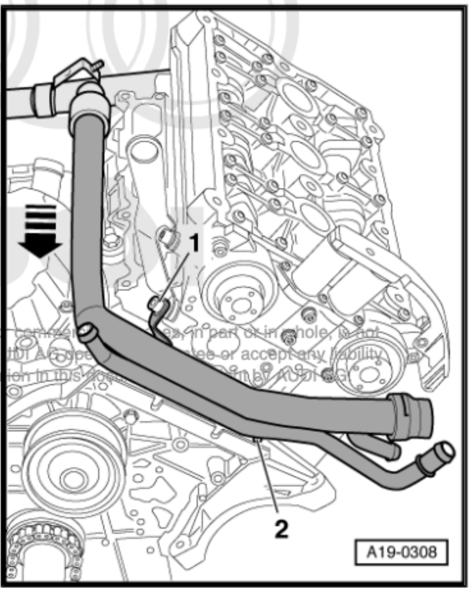
- – Remove intake manifold ⇒ page 94 .
- – Remove toothed belt ⇒ page 62 .
- – Remove camshaft sprockets on cylinder head (left-side).
- – Remove bolts -1- and -2- and take off toothed belt guard (rear left).



- Place drip tray underneath.
- Use hose clips -3094- to clamp off both hoses at hydraulic fluid supply pipe.
- Disconnect both hydraulic hoses from supply pipe.
- Disconnect coolant hoses from coolant pipe (front).



- Unscrew bolts -1- and -2- and move connecting pipes clear of coolant pipe.
- Pull coolant pipe off from front -arrow-.



Installing

Installation is carried out in the reverse order; note the following:

Note

- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Renew O-rings.*

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with “G12” and slide onto coolant pipe.
- Push front coolant pipe into opening in rear coolant pipe.
- Install intake manifold ⇒ page 94 .
- Install toothed belt (adjust valve timing) ⇒ page 69 .
- Fill cooling system ⇒ page 165 .
- Top up power steering fluid and bleed steering system: ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48

Tightening torques

Component		Nm
Coolant pipe (front)	M6	10
to cylinder head	M8	22
Toothed belt guard (rear) to cylinder head/ cylinder block		10 [22]

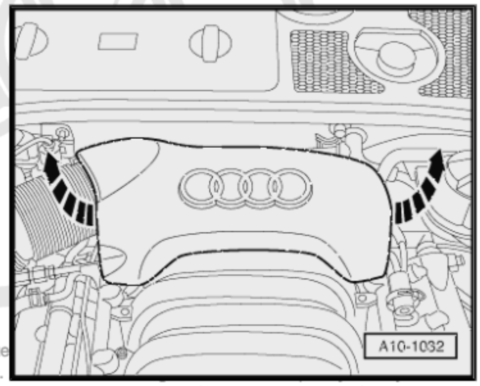
22) Renew bolts.

1.8 Removing and installing coolant pipe (left-side)

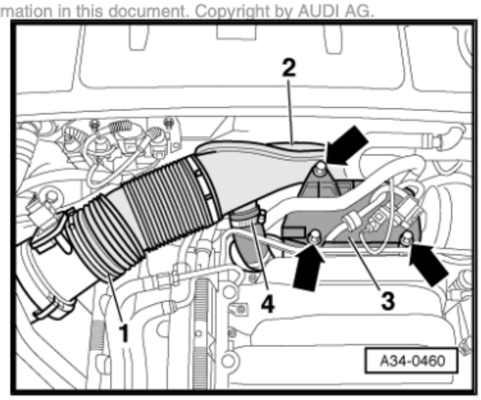
Removing

- Drain off coolant ⇒ page 163 .

- Pull off rear engine cover -arrows-.



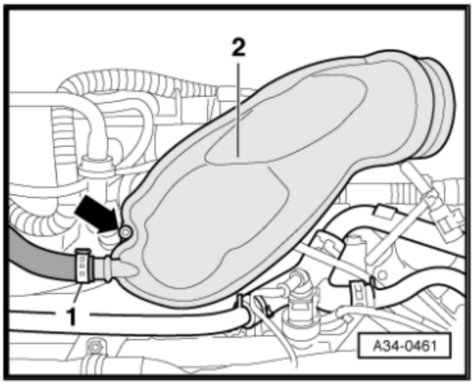
- Detach air intake hose -1- at air mass meter -G70- .
- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Pull hose -4- off air duct -2-.



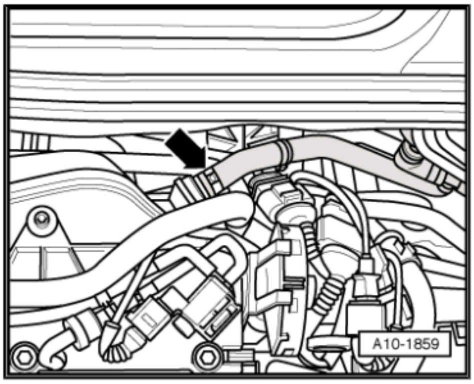
- Unscrew bolt -arrow- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

Note

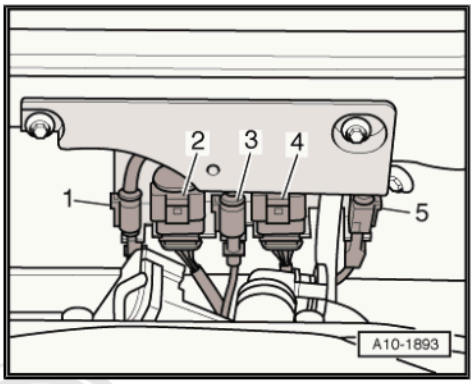
For illustration purposes, the air duct is shown from rear and with engine removed.



- Detach vacuum hose -arrow- going to brake servo at non-return valve.



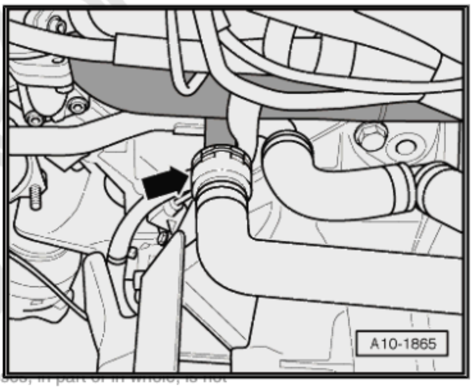
- Unscrew bracket for connectors (rear centre) from bulkhead.
- Remove electrical connectors -1 ... 5- from bracket.



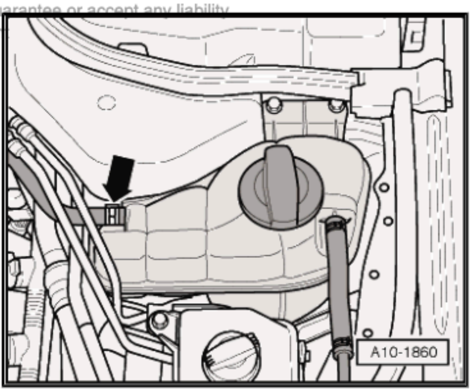
- Detach coolant hose (rear left) -arrow- at engine.

Note

Shown from rear with engine removed for illustration purposes.



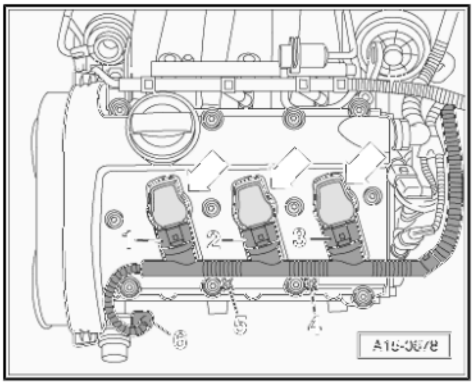
- Detach coolant hose -arrow- at expansion tank.

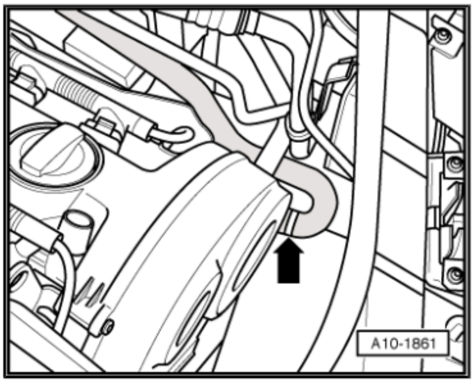


- Unscrew bolts -4- and -5- at cylinder head (left-side).
- Unplug electrical connectors -1 ... 3- and -6- and move wiring harness clear to one side.

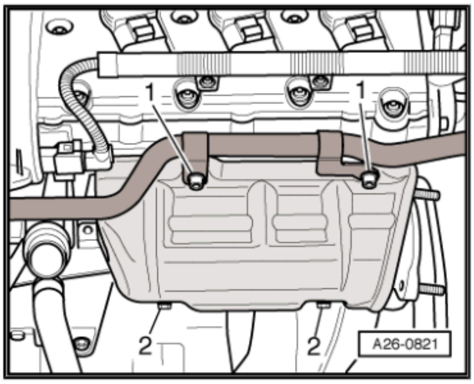
Note

Ignore -arrows-.





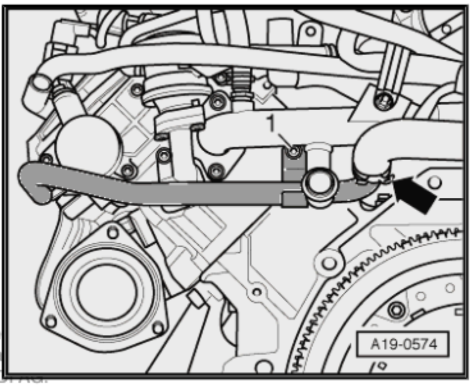
– Detach coolant hose (front left) -arrow- at engine.



– Unscrew bolts -1- for coolant pipe (left-side).

Note

Ignore item marked -2-.



– Disconnect coolant hose -arrow- from coolant pipe (left-side).

– Unscrew bolt -1- and remove coolant pipe (left-side).

Note

Shown from rear with engine removed for illustration purposes.

Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ♦ *Renew O-rings.*

– Fill cooling system ⇒ page 165 .

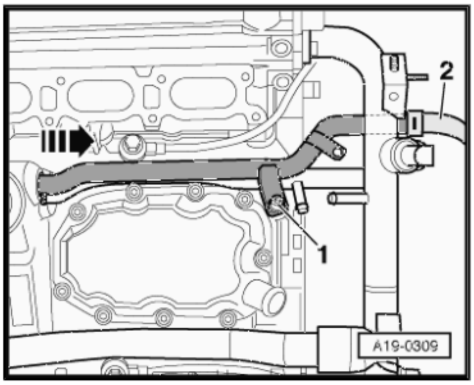
Tightening torques

Component		Nm
Air pipe to throttle valve module -J338-		10
Retaining plate for solenoid valves to	Intake manifold	10
	Air duct	10

1.9 Removing and installing coolant pipe (right-side)

Removing

– Remove intake manifold ⇒ page 94 .



- Disconnect rear coolant hose -2- from coolant pipe (right-side).
- Remove bolt -1-.
- Pull coolant pipe (right-side) out of cylinder block towards the rear -arrow-.
- Take out coolant pipe from the top.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew O-rings.

- Before installing, clean and smoothen sealing surface for O-ring.
- Lubricate new O-ring with “G12” and slide onto coolant pipe.
- Slide coolant pipe into bore in cylinder block.
- Install intake manifold ⇒ page 94 .
- Fill cooling system ⇒ page 165 .

Tightening torque

Component	Nm
Coolant pipe (right-side) to cylinder block	10

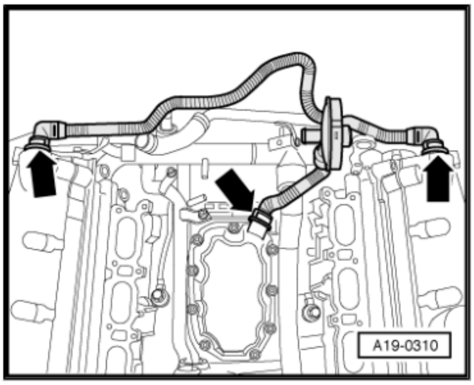
1.10 Removing and installing coolant pipe (rear)

Removing

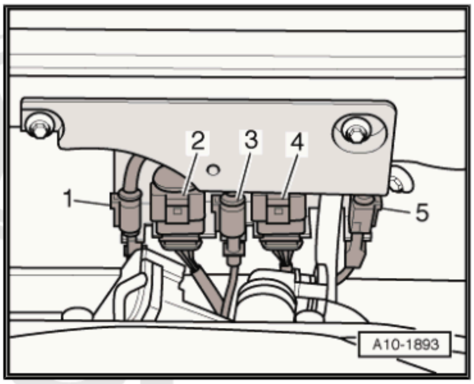
Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

- Remove intake manifold ⇒ page 94 .
- Remove coolant pipe (right-side) ⇒ page 179 .
- Move pipes clear of crankcase breather hose.
- Remove crankcase breather hose -arrows-.



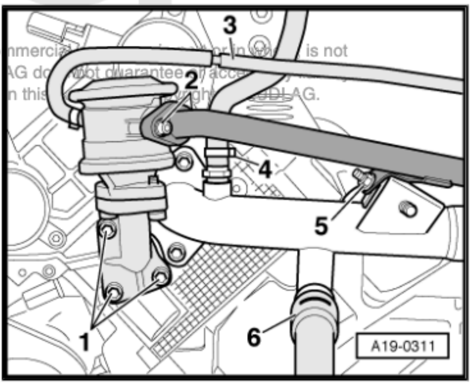
- Unscrew bracket for connectors (rear centre) from bulkhead.
- Remove electrical connectors -1 ... 5- from bracket.



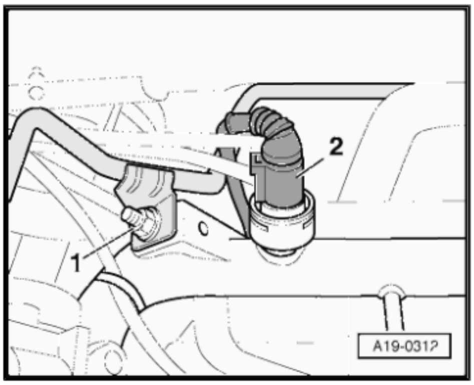
- Disconnect coolant hose -4-.
- Unscrew bolts -2- and nut -5-, and detach secondary air pipe.
- Disconnect vacuum hose -3- leading to combination valve.
- Unscrew bolts -1- and take off combination valve for secondary air system.
- Disconnect coolant hose -6-.

Note

Shown from rear with engine removed for illustration purposes.



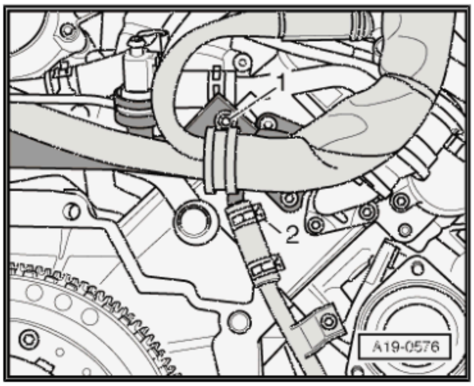
- Unplug electrical connector -2- from coolant temperature sender -G2- / coolant temperature sender -G62- .
- Unscrew power steering hydraulic pipe at coolant pipe (rear) -1-.



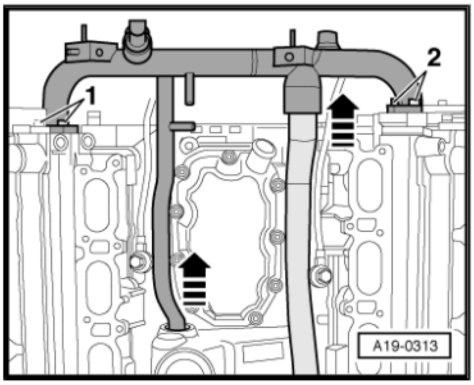
- Unbolt retaining clamp -1- for electrical wiring harness from rear coolant pipe (right-side).
- Repeat procedure on opposite side of vehicle.
- Disconnect coolant hose -2- leading to alternator at coolant pipe (rear).

Note

Shown from rear with engine removed for illustration purposes.



- Unscrew bolts -1- and -2-.
- Pull coolant pipe off towards rear.



Installing

Installation is carried out in the reverse order; note the following:

Note

- ♦ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- ♦ *Renew seals and O-rings.*

- Before installing, clean and smooth down sealing surfaces for O-rings as required.
- Lubricate new O-rings with “G12” and slide onto coolant pipe.
- Install coolant pipe (right-side) ⇒ page 179 .
- Fill cooling system ⇒ page 165 .

Tightening torques

Component	Nm
Coolant pipe (rear) to cylinder head	10
Retaining clamp for wiring harness to coolant pipe (rear)	10
Power steering pressure pipe to coolant pipe	20
Connecting pipe to combination valve	10
Connecting pipe to coolant pipe (rear)	10

1.11 Removing and installing coolant pipe leading to alternator

Removing

- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

WARNING

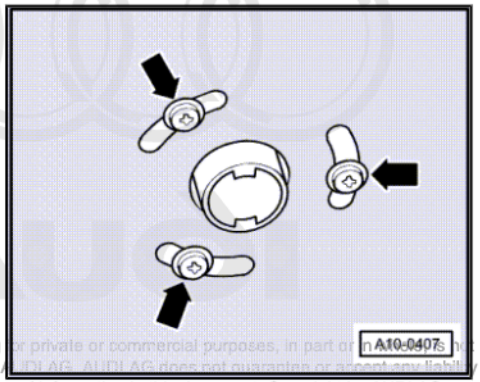
Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

- Open filler cap on coolant expansion tank.
- Remove front right wheel.

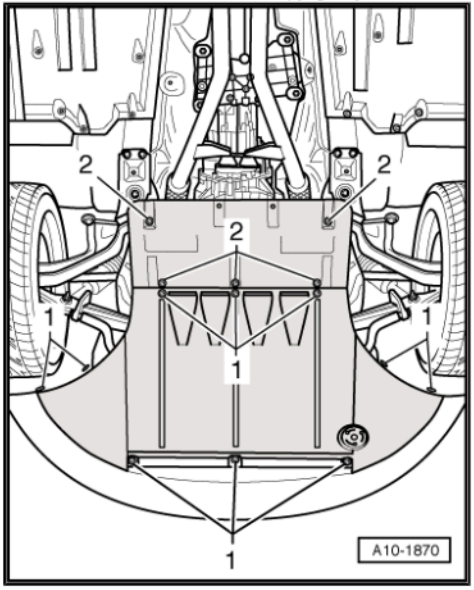
Note

Secure brake disc with wheel bolts.

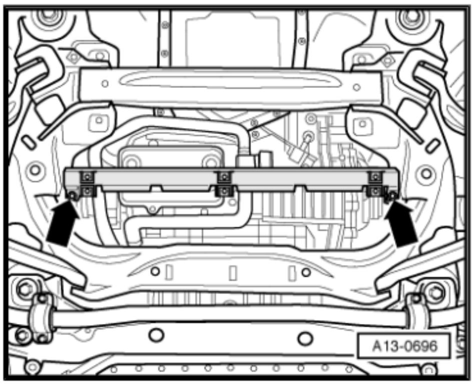
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.

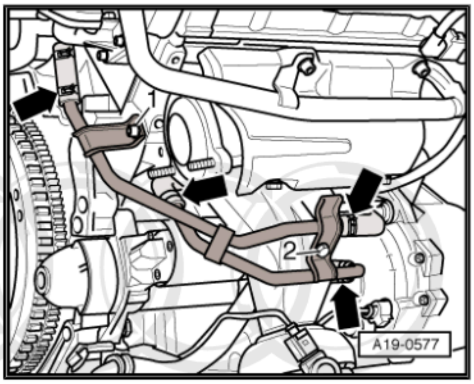


- Loosen quick release fasteners -1- and -2- and remove noise insulation parts.



- Unbolt bracket for noise insulation -arrows-.
- Drain off coolant ⇒ page 163 .





- Remove combination valve for secondary air (right-side) ⇒ page 236 .
- Unscrew bolts -1- and -2-.
- Disconnect hoses -arrows-.
- Detach coolant pipe.

Note

Shown from rear with engine removed for illustration purposes.

Installing

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.

Audi
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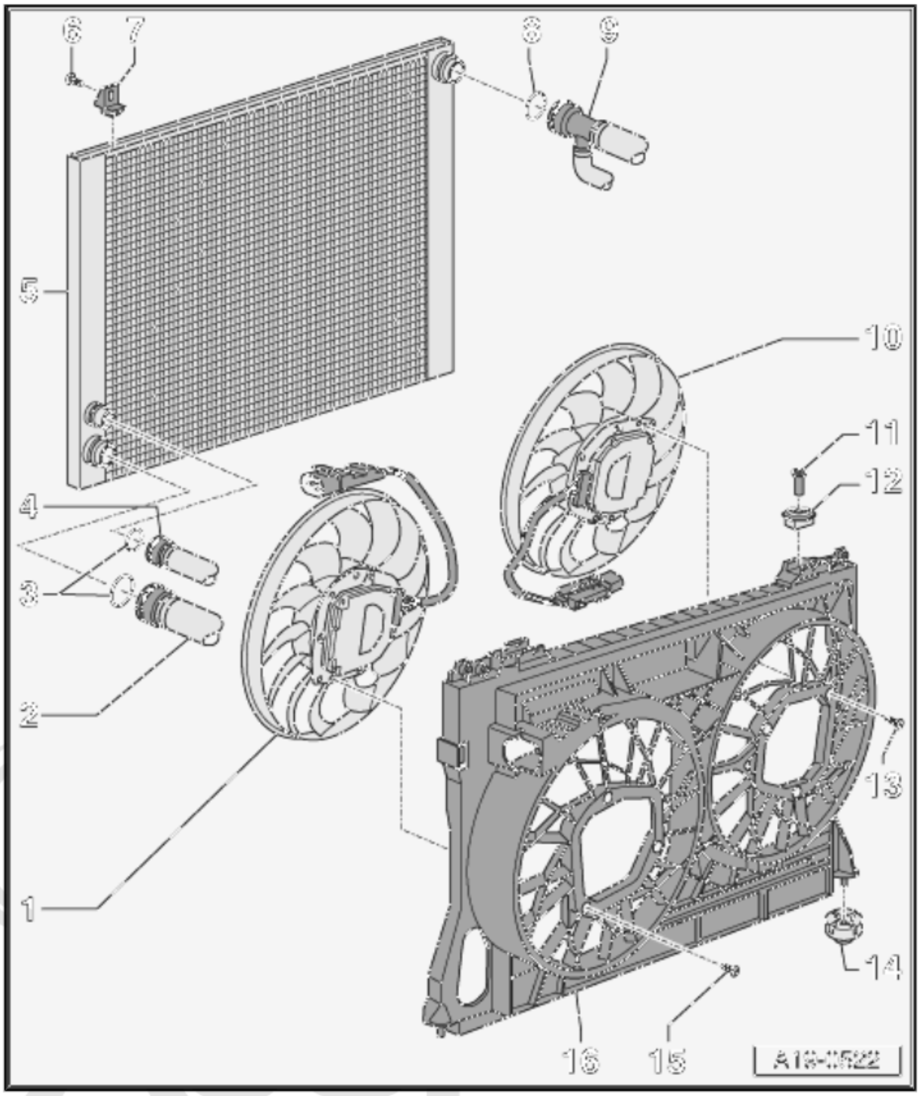
- Install combination valve for secondary air (right-side) ⇒ page 236 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Fill cooling system ⇒ page 165 .

Tightening torques

Component		Nm
Coolant pipe to	Engine support	10
Alternator to	Cylinder head	10

2 Cooling system - on body

2.1 Radiator and radiator fan - exploded view of components



1 - Radiator fan -V7-
  - ❑ With radiator fan control unit -J293-
  - ❑ Removing and installing ⇒ page 190

2 - Coolant hose
  - ❑ To detach, release retaining clip

3 - O-ring
  - ❑ Renew

4 - Not installed

5 - Radiator
  - ❑ Removing and installing ⇒ page 185
  - ❑ After replacing, renew coolant completely

6 - 6 Nm

7 - Bracket for radiator

8 - O-ring
  - ❑ Renew

9 - Coolant hose
  - ❑ To detach, release retaining clip

10 - Radiator fan -2- -V177-
  - ❑ With radiator fan control unit 2 -J671-
  - ❑ Removing and installing ⇒ page 190

11 - Retaining pin

12 - Rubber buffer
  - ❑ Use screwdriver to release and pull off

13 - 10 Nm

14 - Rubber bush

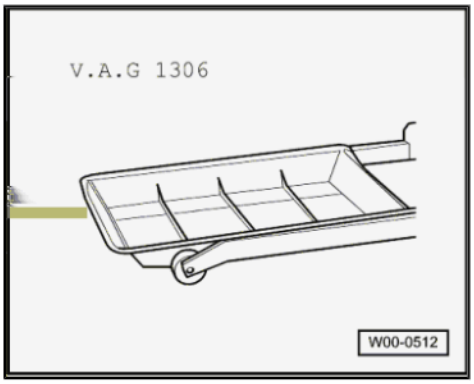
15 - 10 Nm

16 - Radiator cowl
  - ❑ Removing and installing ⇒ page 189

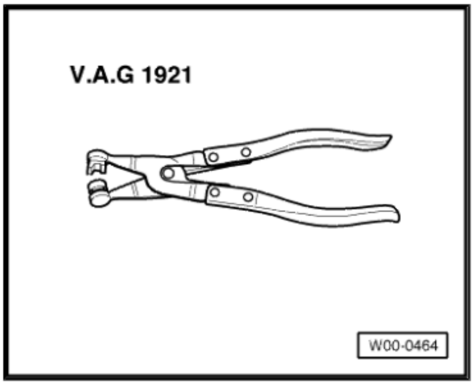
2.2 Removing and installing radiator

Special tools and workshop equipment required

- Drip tray -V.A.G 1306-



- Hose clip pliers -V.A.G 1921-



Removing

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

WARNING

Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.

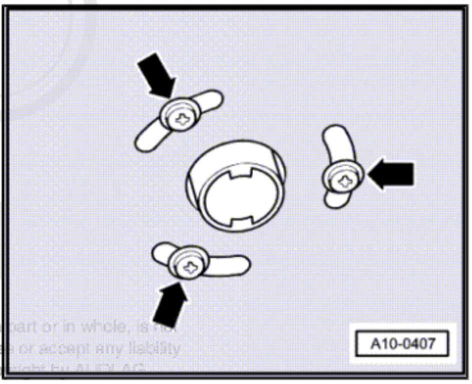
– Open filler cap on coolant expansion tank.

– Remove both front wheels.

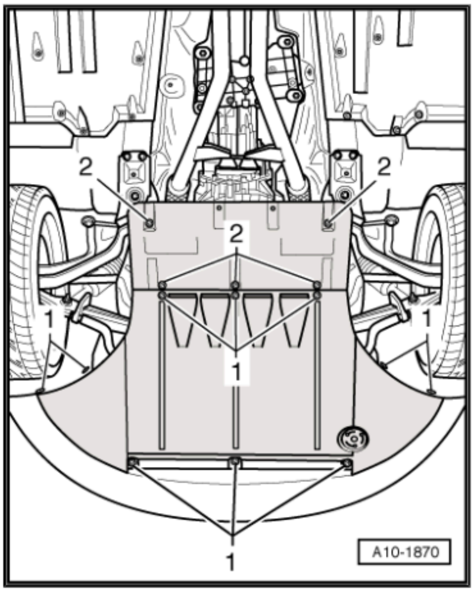
Note

Secure brake discs with wheel bolts.

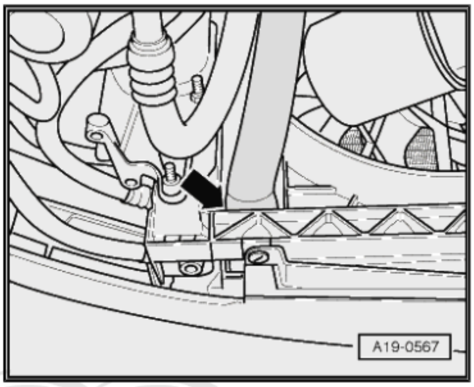
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



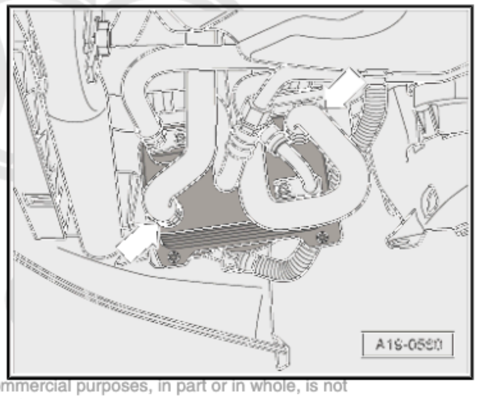
- Loosen quick release fasteners -1- and remove front noise insulation.



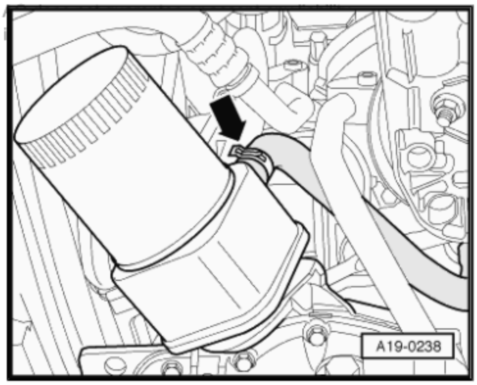
- Place drip tray -V.A.G 1306- under engine.
- Detach coolant hose from bottom left of radiator -arrow- and drain off coolant.



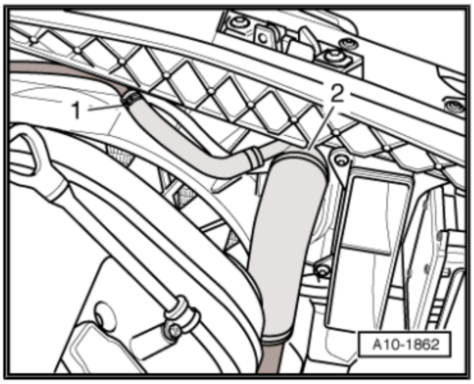
- Disconnect coolant hoses -arrows- from ATF cooler and drain off coolant.



- Also disconnect coolant hose at oil cooler -arrow-, and drain off remaining coolant.
- Remove front section of wheel housing liner (front left and front right) ⇒ General body repairs, exterior; Rep. Gr. 66 .
- Remove front bumper ⇒ General body repairs, exterior; Rep. Gr. 63 .



- Remove upper coolant hose -2- from radiator by pulling off retaining clip.



Note

Ignore item marked -1-.

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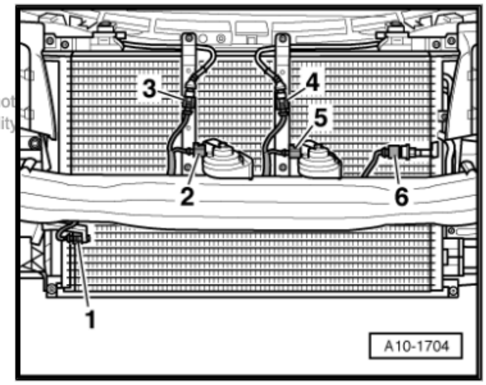
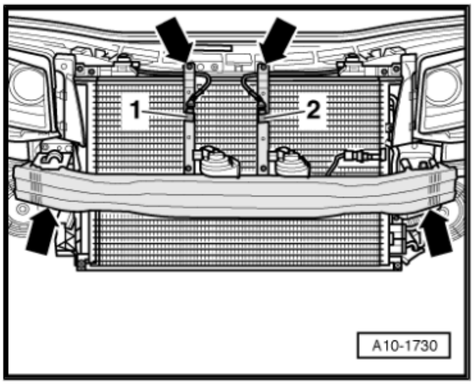
- Unplug electrical connectors -1 ... 6- and move electrical wires clear.
- Remove bracket for ambient temperature sensor -G17- by turning bracket 90° in clockwise direction and then detaching it.



- Unplug electrical connectors -1- and -2- from struts.
- Unscrew bolts -arrows-.
- Remove bumper together with struts.



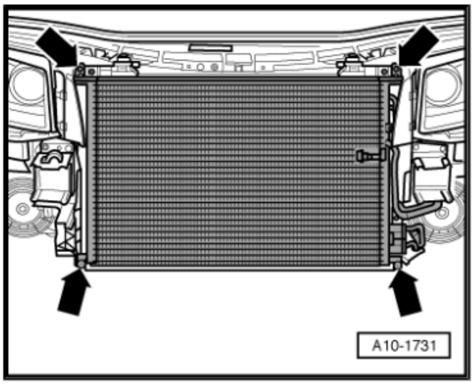
WARNING

Refrigerant circuit of air conditioner must not be opened.

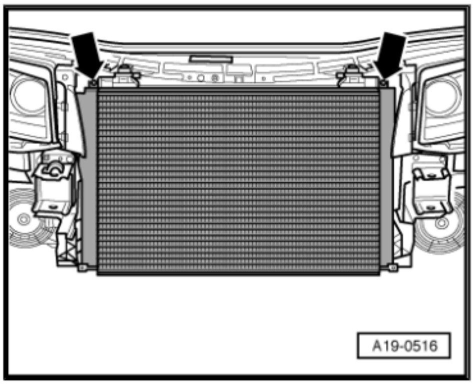
Note

To prevent damage to the air conditioner compressor and coolant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Unscrew bolts -arrows-.
- Swivel down condenser together with cooler for power-assisted steering and secure by tying to engine.



- Remove the two brackets for radiator -arrows-.
- Tilt top of radiator forwards slightly and lift out of lock carrier.



Installing

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.

- Install front bumper ⇒ General body repairs, exterior; Rep. Gr. 63 .
- Install front section of wheel housing liner (front left and front right) ⇒ General body repairs, exterior; Rep. Gr. 66 .
- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Fill cooling system ⇒ page 165 .

Note

After renewing the radiator you must also renew entire coolant.

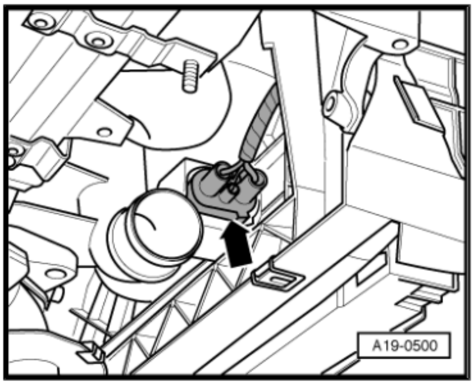
Tightening torque

Component	Nm
Bracket for radiator to lock carrier	6
Condenser to lock carrier	6
Struts to lock carrier	9
Bumper to impact damper	23

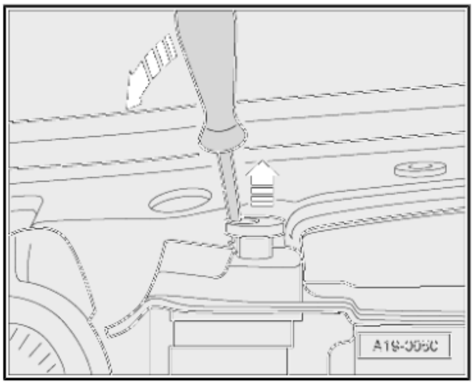
2.3 Removing and installing radiator cowl

Removing

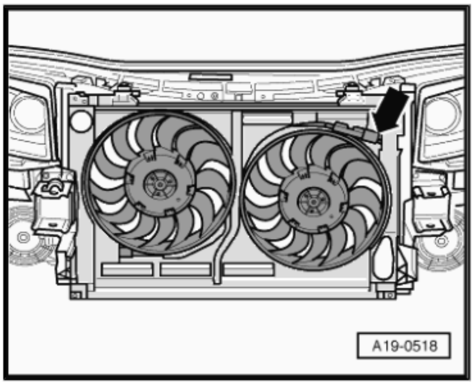
- Drain off coolant ⇒ page 163 .
- Remove radiator ⇒ page 185 .
- Unplug electrical connector -arrow- for radiator fan (right-side).
- Move wires clear at rear of lock carrier.



- Release both retaining pins for radiator cowl and pull out upwards -arrows-.



- Tilt top edge of radiator cowl forwards.
- Unplug electrical connector -arrow- for radiator fans; to do so, reach behind the radiator cowl.
- Remove radiator cowl.



Installing

Installation is carried out in the reverse order; note the following:

- Install radiator ⇒ page 185 .
- Fill cooling system ⇒ page 165 .

Tightening torque

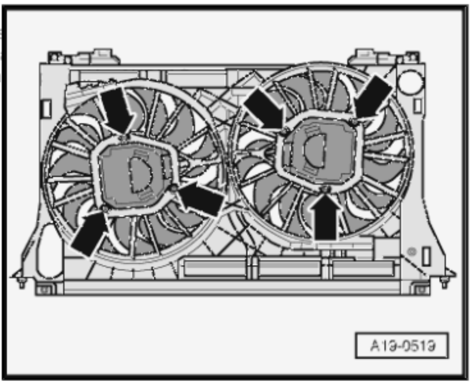
Component	Nm
Radiator fan to radiator cowl	10 23)

23) Renew bolt.

2.4 Removing and installing radiator fan

Removing

- Drain off coolant ⇒ page 163 .
- Remove radiator ⇒ page 185 .
- Remove radiator cowl ⇒ page 189 .
- Unscrew bolts -arrows-.
- Unclip electrical connectors and move electrical wires clear.
- Remove radiator fans.



Installing

Installation is carried out in the reverse order; note the following:

- Install radiator cowl ⇒ page 189 .
- Install radiator ⇒ page 185 .
- Fill cooling system ⇒ page 165 .

Tightening torque

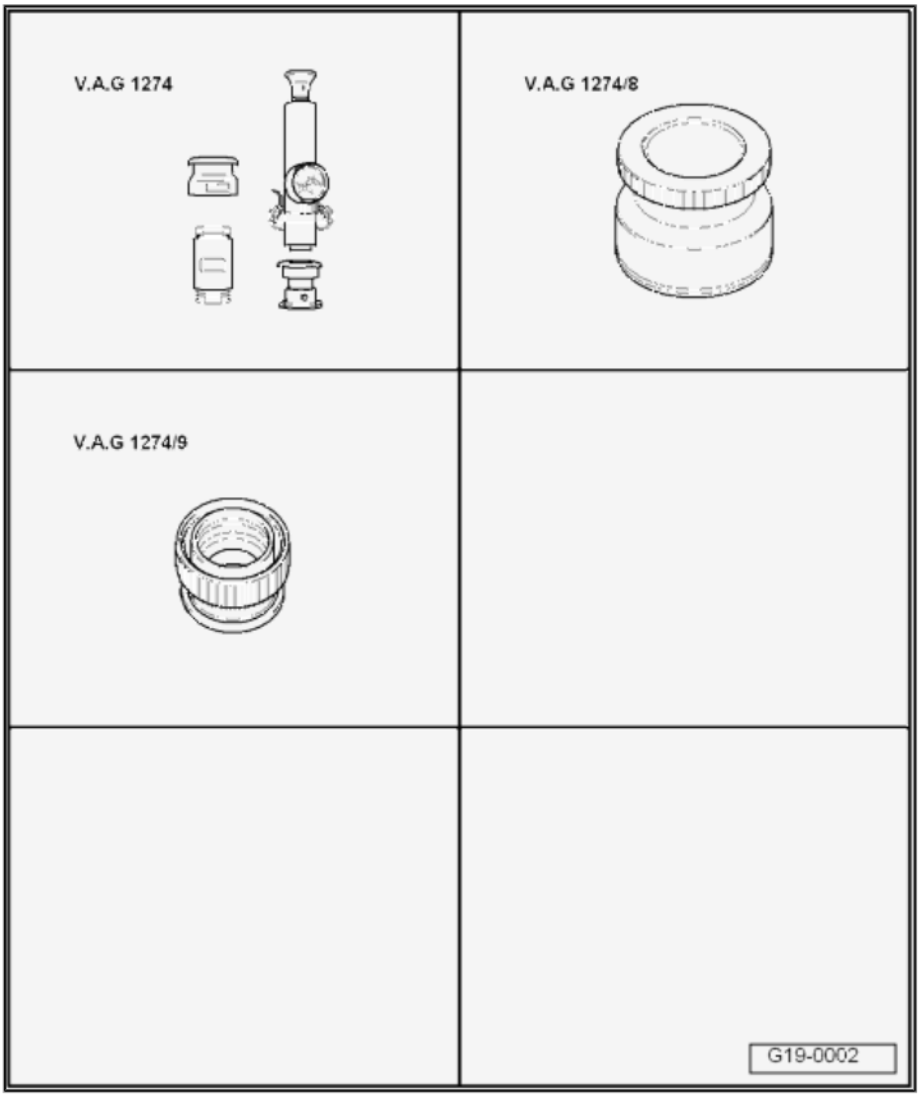
Component	Nm
Radiator fan to radiator cowl	10 24)

24) Renew bolt.

2.5 Checking cooling system for leaks

Special tools and workshop equipment required

- Cooling system tester -V.A.G 1274-
- Adapter for cooling system tester -V.A.G 1274/8-
- Adapter for cooling system tester -V.A.G 1274/9-



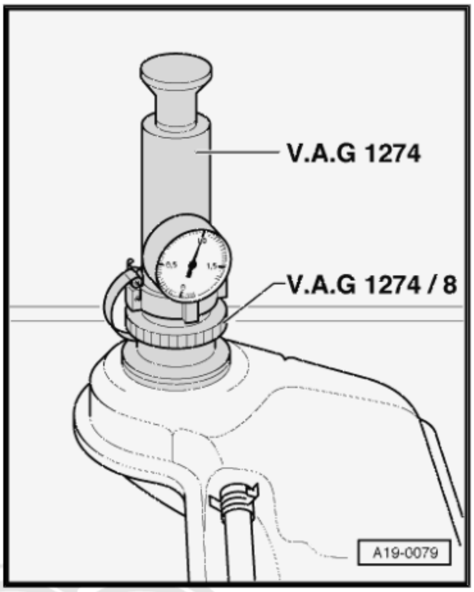
Test condition

- Engine must be warm.

Test sequence

> **WARNING**
>
> *Hot steam or hot coolant can escape when expansion tank is opened; cover filler cap with cloth and open carefully.*

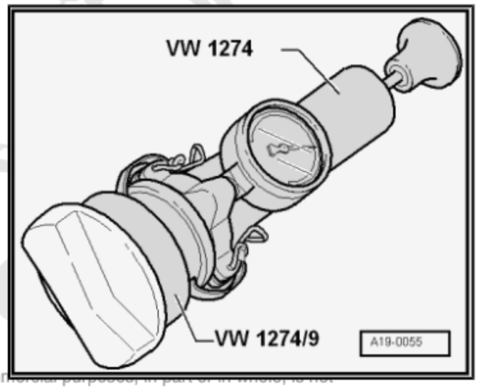
– Open filler cap on coolant expansion tank.



- Attach cooling system tester -V.A.G 1274- with adapter -V.A.G 1274/8- to expansion tank.
- Use hand pump on cooling system tester to create a pressure of approx. 1.0 bar.

If the pressure drops:

- Trace leak and repair.



Checking pressure relief valve in filler cap

- Attach cooling system tester -V.A.G 1274- with adapter -V.A.G 1274/9- to filler cap.
- Use hand pump on cooling system tester to create pressure.
- The pressure relief valve should open at pressure of 1.4 ... 1.6 bar.

If the relief valve does not open as described:

- Renew the filler cap.

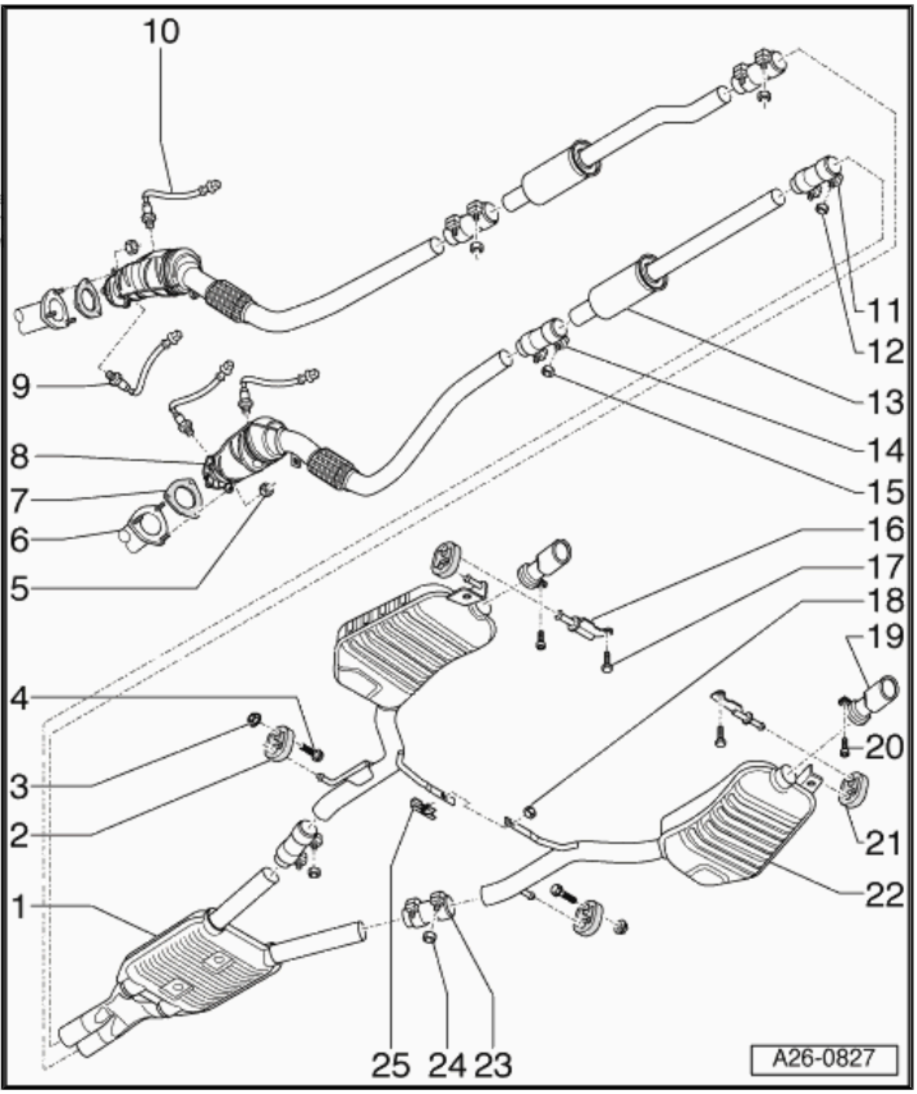
26 – Exhaust system

1 Removing and installing parts of exhaust system

Note

- *Renew gaskets and self-locking nuts.*
- *After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the body. If necessary, loosen clamps and align silencers and exhaust pipes so that sufficient clearance is maintained to the body at all points and the mountings are evenly loaded.*
- *The flexible joint in front exhaust pipe must not be bent more than 10 ° - damage can otherwise occur.*

1.1 Exhaust system - exploded view of components



1 - Centre silencer
  - ☐ Centre and rear silencer are one unit as original equipment. Can be renewed individually for repair purposes
  - ☐ Cutting location ⇒ page 198
  - ☐ Align exhaust system so it is free of stress ⇒ page 215

2 - Rubber mounting
  - ☐ Check pretension, refer to "Stress-free alignment of exhaust system" ⇒ page 215

3 - 23 Nm

4 - Bolt

5 - 27 Nm
  - ☐ Renew

6 - Exhaust manifold
  - ☐ Removing and installing: left-side ⇒ page 212 , right-side ⇒ page 213

7 - Gasket
  - ☐ Renew

8 - Front exhaust pipe with catalytic converter
  - ☐ With flexible joint
  - ☐ Do not bend flexible joint more than 10° - otherwise it can be damaged
  - ☐ Protect against knocks and impact

Prote
perm
w

- Combined with front silencer as original equipment. Can be renewed individually for repair purposes
- Removing and installing: left-side ⇒ page 199 , right-side ⇒ page 205
- Cutting location ⇒ page 197
- Mounting components: left-side ⇒ page 196 , right-side ⇒ page 196
- Align exhaust system so it is free of stress ⇒ page 215

9 - Lambda probe before catalytic converter

- Threads of new lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- When re-using the old Lambda probe, grease thread with high-temperature lubricant; the paste must not get into the slots of the probe body; High-temperature lubricant ⇒ Parts catalogue
- Removing and installing ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24
- Tighten to 55 Nm

10 - Lambda probe after catalytic converter

- Threads of new lambda probes are already greased with assembly paste; the paste must not get into the slots on the probe body
- When re-using the old Lambda probe, grease thread with high-temperature lubricant; the paste must not get into the slots of the probe body; High-temperature lubricant ⇒ Parts catalogue
- Removing and installing ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24
- Tighten to 55 Nm

11 - Clamp (centre)

- Position clamp so that it aligns with centre of cutting location
- Installation position ⇒ page 195
- Before tightening bolt connection, align exhaust system free of stress ⇒ page 215
- Tighten bolt connections evenly

12 - 23 Nm

13 - Front silencer

- As original equipment, front silencer and front exhaust pipe/catalytic converter are supplied as one unit. Can be renewed individually for repair purposes
- Removing and installing: left-side ⇒ page 199 , right-side ⇒ page 205
- Cutting location ⇒ page 197
- Align exhaust system so it is free of stress ⇒ page 215

14 - Clamp (front)

- To enable individual renewal of front exhaust pipe/catalytic converter and front silencer
- Position clamp so that it aligns with centre of cutting location
- Installation position ⇒ page 195
- Before tightening bolt connection, align exhaust system free of stress ⇒ page 215
- Tighten bolt connections evenly

15 - 23 Nm

16 - Mounting

17 - 22 Nm

18 - 23 Nm

- Renew

19 - Tailpipe

- Align, refer to "Stress-free alignment of exhaust system" ⇒ page 215

20 - 30 Nm

- Bolt strength 10.9

21 - Rubber mounting

- Check pretension, refer to "Stress-free alignment of exhaust system" ⇒ page 215

22 - Rear silencer

- ❑ Rear and centre silencer are one unit as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting location ⇒ page 198
- ❑ Align exhaust system so it is free of stress ⇒ page 215

23 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Position clamp so that it aligns with centre of cutting location
- ❑ Installation position ⇒ page 195
- ❑ Before tightening bolt connection, align exhaust system free of stress ⇒ page 215
- ❑ Tighten bolt connections evenly

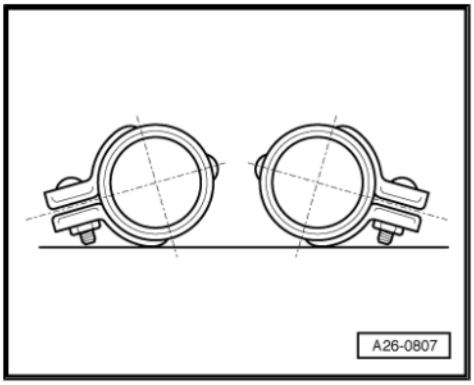
24 - 23 Nm

25 - Connecting bracket

Installation position of front clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

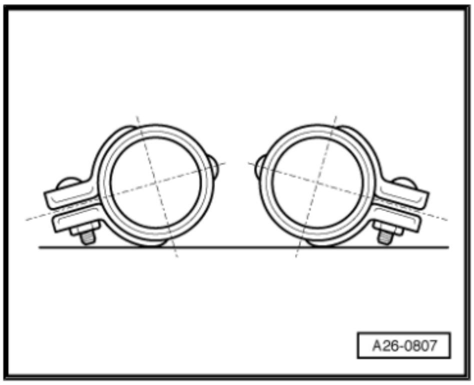
- Bolt connections face outwards.



Installation position of middle clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

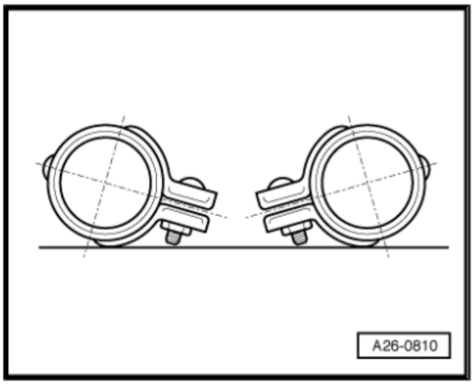
- Bolt connections face outwards.



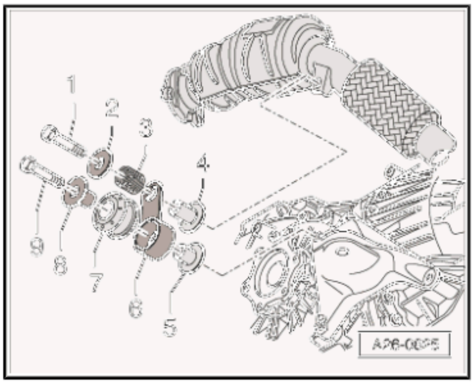
Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

- Bolt connections face one another.



Mounting components (left-side)



1 - Bolt -25 Nm-

2 - Washer

3 - Compression spring

4 - Spacer sleeve

5 - Spacer sleeve

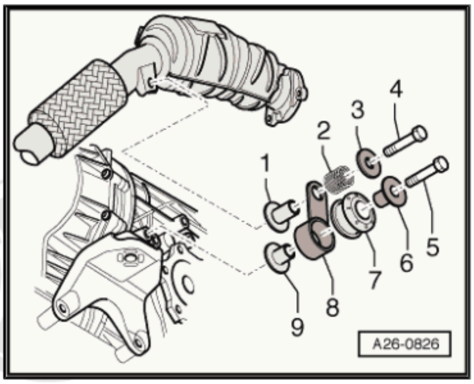
6 - Bracket

7 - Buffer

8 - Spacer sleeve

9 - Bolt -25 Nm-

Mounting components (right-side)



1 - Spacer sleeve

2 - Compression spring

3 - Washer

4 - Bolt -25 Nm-

5 - Bolt -25 Nm-

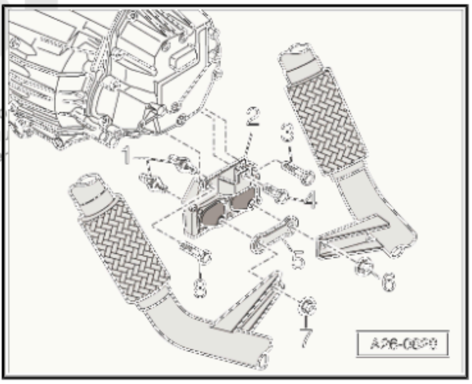
6 - Spacer sleeve

7 - Buffer

8 - Bracket

9 - Spacer sleeve

Centre mounting components on vehicles with front-wheel drive



1 - Studs

2 - Bracket

3 - Bolt -25 Nm-

4 - Bolt -25 Nm-

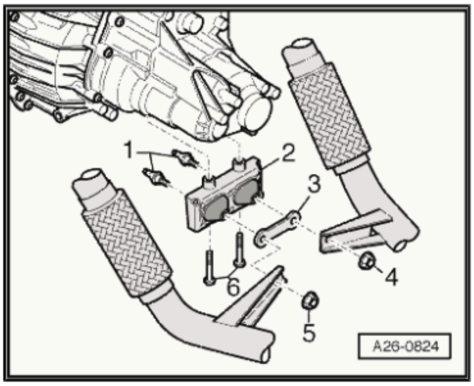
5 - Bracket

6 - Nut, self-locking -25 Nm-

7 - Nut, self-locking -25 Nm-

8 - Bolt -25 Nm-

Centre mounting components on vehicles with four-wheel drive



1 - Studs

2 - Bracket

3 - Bracket

4 - Nut, self-locking -25 Nm-

5 - Nut, self-locking -25 Nm-

6 - Bolts -25 Nm-

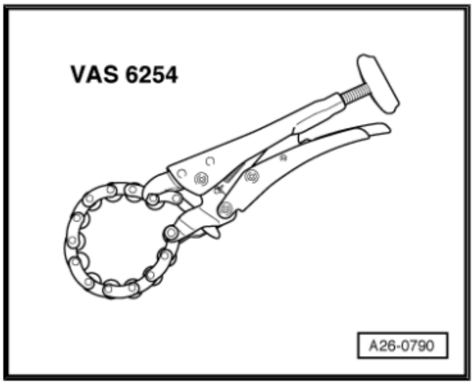
1.2 Separating front exhaust pipe and front silencer

The connecting pipe can be cut through at the point marked so that the front exhaust pipe/catalytic converter and front silencer can be renewed separately.

Cutting location is marked by an indentation on circumference of exhaust pipe.

Special tools and workshop equipment required

- Chain tube cutter -VAS 6254-

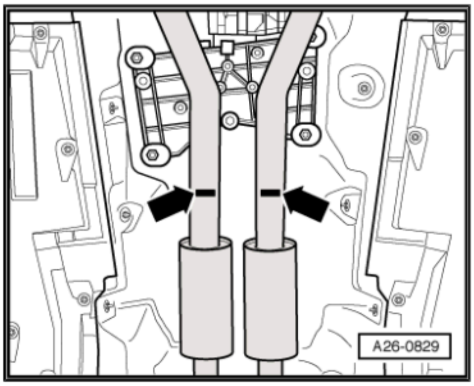


- Safety goggles

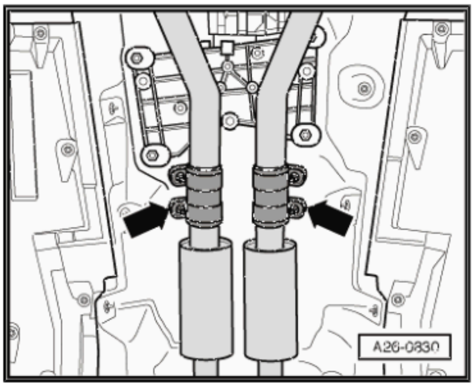
Procedure

> **WARNING**
>
> *Wear safety goggles.*

– Separate the relevant exhaust pipe using the chain tube cutter -VAS 6254- to cut at a right angle; cutting location is shown in illustration -arrows-.



– Position the relevant clamp so that it aligns with centre of cutting location -arrows-.

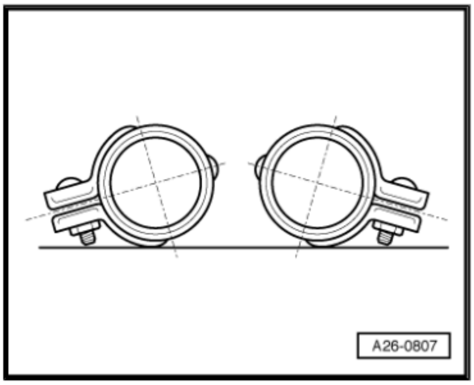


- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

- Bolt connections face outwards.

- Before tightening bolt connection, align exhaust system free of stress ⇒ page 215 .

- Tighten bolt connections of clamps evenly to 23 Nm.



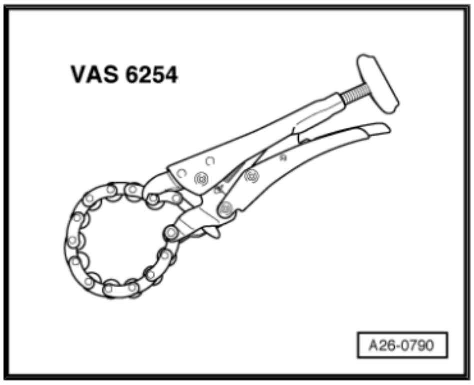
1.3 Separating centre and rear silencers

The connecting pipe can be cut through at the cutting location in order to renew the centre and rear silencers separately.

Cutting location is marked by an indentation on circumference of exhaust pipe.

Special tools and workshop equipment required

- Chain tube cutter -VAS 6254-

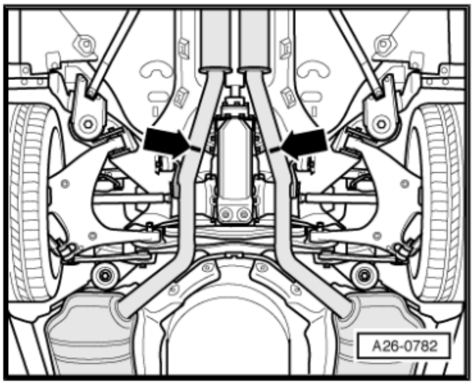


- Safety goggles

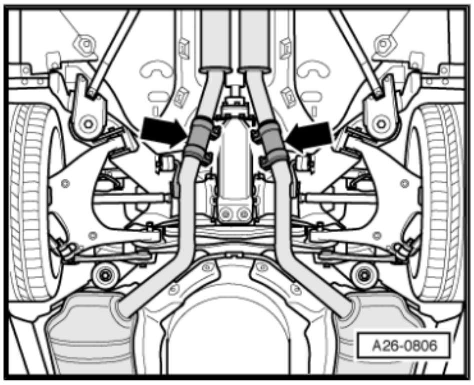
Procedure

> WARNING
>
> *Wear safety goggles.*

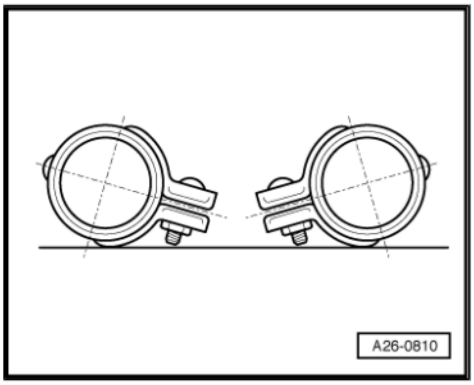
- Separate the relevant exhaust pipe using the chain tube cutter -VAS 6254- to cut at a right angle; cutting location is shown in illustration -arrows-.



- Position the relevant clamp so that it aligns with centre of cutting location -arrows-.



- Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

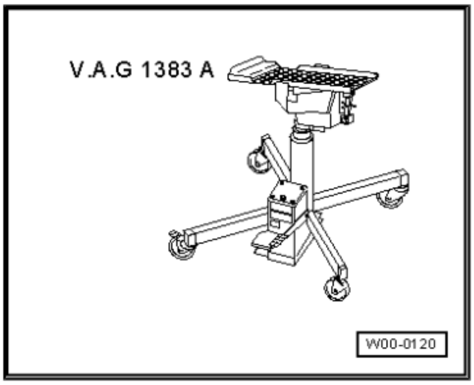


- Bolted connections face inwards.
- Before tightening bolt connection, align exhaust system free of stress ⇒ page 215 .
- Tighten bolt connections of clamps evenly to 23 Nm.

1.4 Removing and installing front exhaust pipe (left-side) with catalytic converter

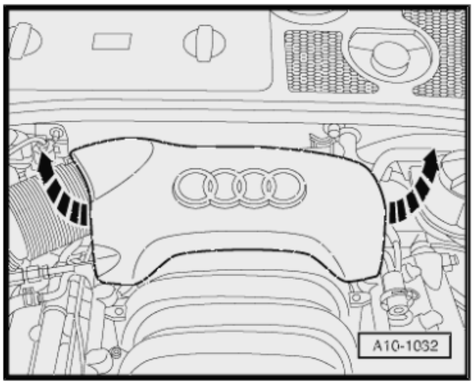
Special tools and workshop equipment required

- ♦ Engine/gearbox jack -V.A.G 1383 A-

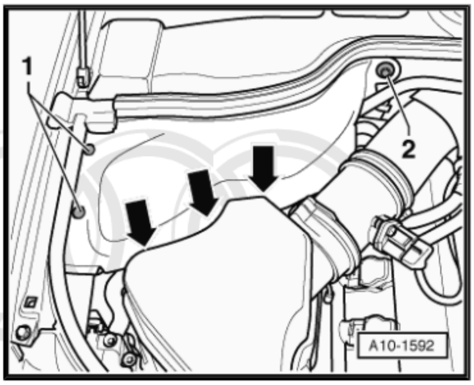


Removing

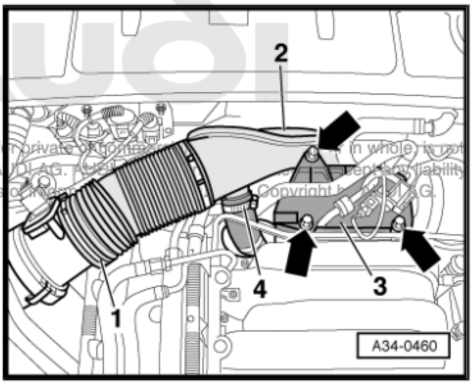
- Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- Pull off rear engine cover -arrows-.



- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- Pull cover out of retainers -arrows-.



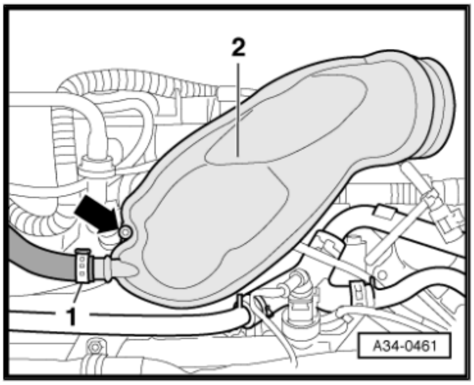
- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Detach air intake hose -1- at air mass meter -G70- .
- Pull hose -4- off air duct -2-.



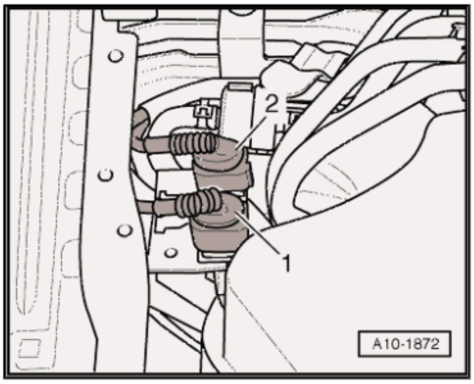
- Unscrew bolt -arrow- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

Note

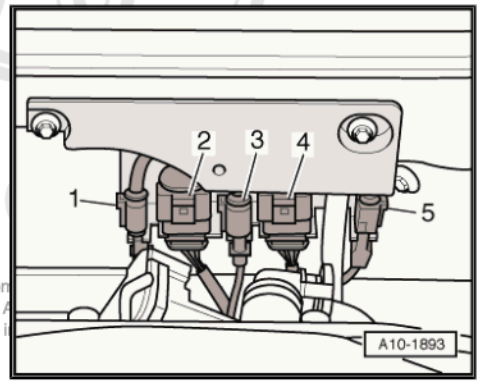
For illustration purposes, the air duct is shown from rear and with engine removed.



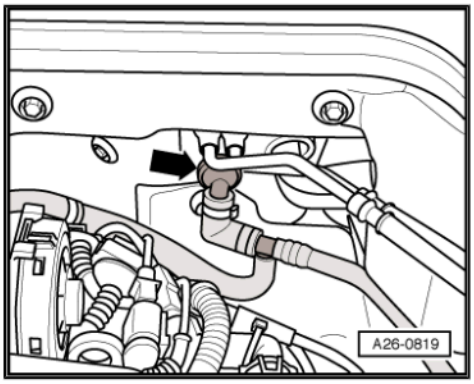
- Detach electrical connector -2- from bracket and unplug.



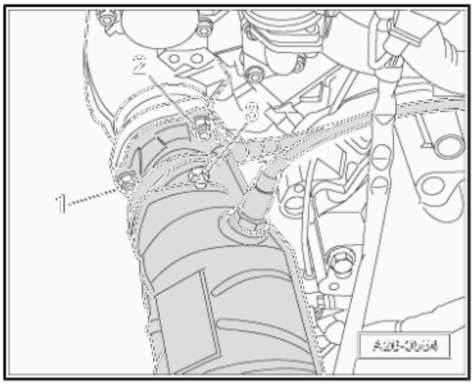
- Unscrew bracket for connectors (rear centre) from bulkhead.
- Remove electrical connectors -1 ... 5- from bracket.
- Detach electrical connector -4-.
- Guide wiring for Lambda probes downwards.



- Detach vacuum hose -arrow- going to brake servo at bulkhead.



- Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold.



Note

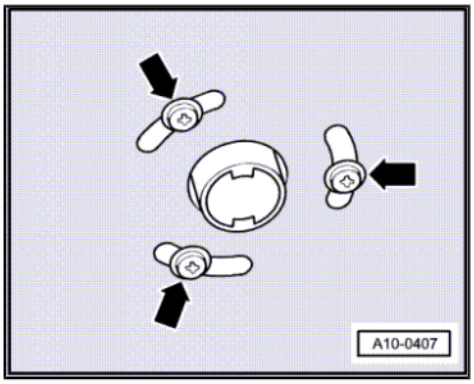
Shown from rear with engine removed for illustration purposes.

- Remove front left wheel.

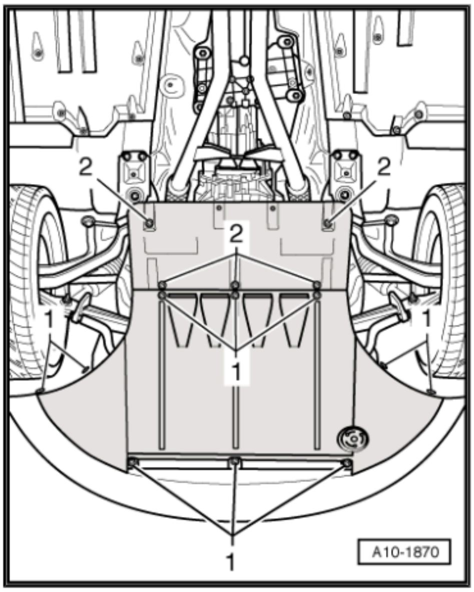
Note

Secure brake disc with wheel bolts.

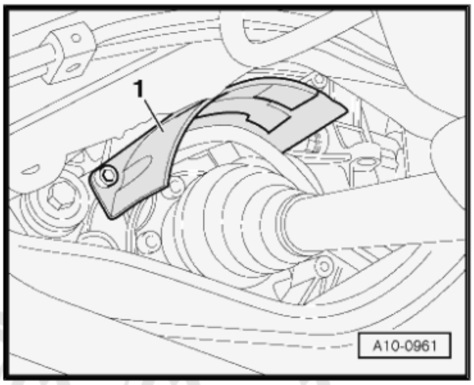
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



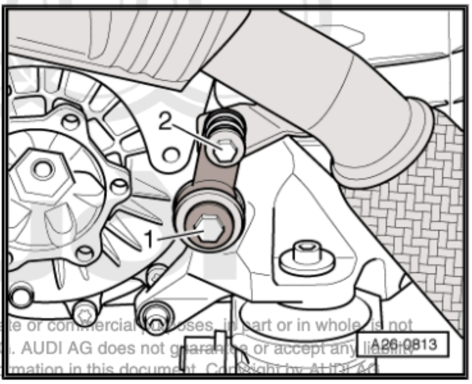
- Loosen quick release fasteners -1- and -2- and remove noise insulation parts.



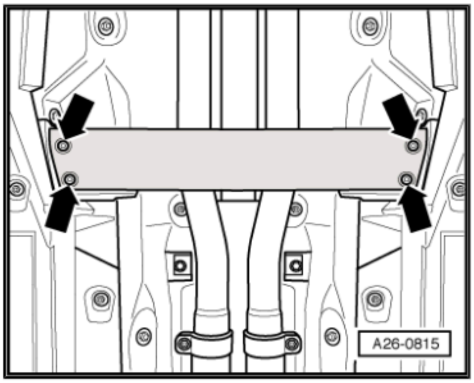
- Unbolt heat shield -1- for drive shaft (left-side).



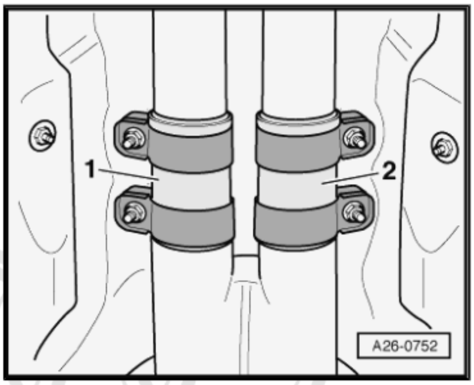
- Unscrew bolts -1- and -2- and remove bracket for front exhaust pipe.



- Remove front cross member -arrows-.



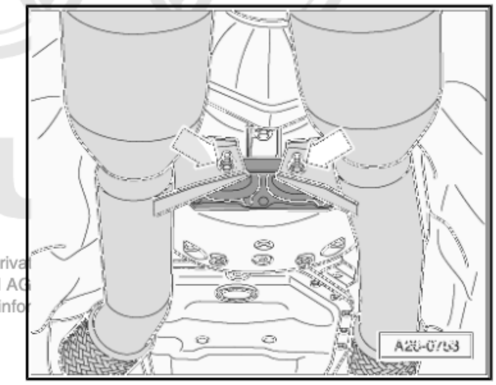
Disconnect exhaust system at clamp (left-side) -1-.



Note

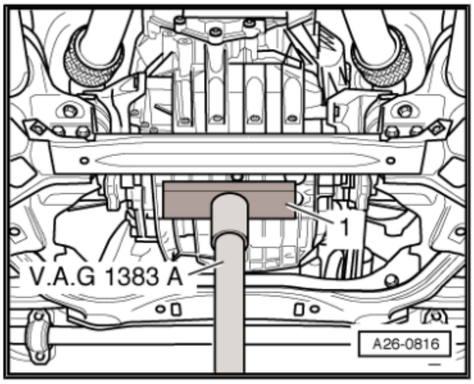
The flexible joint in front exhaust pipe must not be bent more than 10° - damage can otherwise occur.

– Unscrew nut -left arrow- at mounting bracket for front exhaust pipe (left-side).



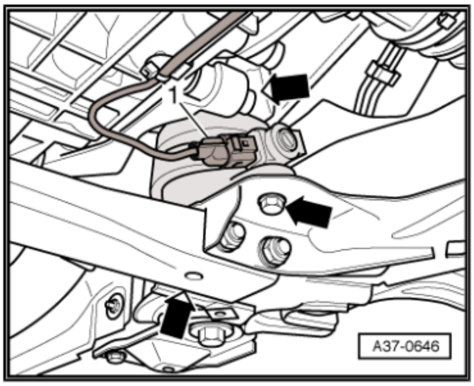
– Detach universal support -V.A.G 1359/2- from engine and gearbox jack -V.A.G 1383 A- and in their place put a wooden block -1- on the lifting arm.

– Using engine and gearbox jack -V.A.G 1383 A- and wooden block raise gearbox slightly.

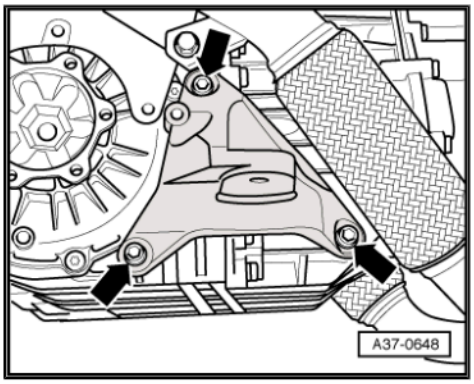


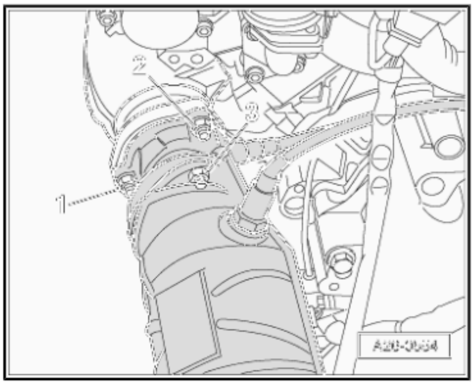
– Unplug electrical connector -1- at gearbox mounting (left-side).

– Unscrew bolts -arrows- and remove gearbox mounting (left-side).



- Unbolt gearbox support (left-side) -arrows-.





- Move Lambda probe wires clear.
- Unscrew nuts -1- and -3- (accessible from below) connecting front exhaust pipe to exhaust manifold.

Note

Shown in illustration with engine removed.

- Remove front exhaust pipe with catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, O-ring and self-locking nuts.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Fit all cable ties in the original position when installing.*
- *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent probe wires from coming into contact with exhaust pipe.*

- Install gearbox support and gearbox mounting ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 37 or ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 37 .
- Align exhaust system free of stress ⇒ page 215 .

Note

Mounting components for exhaust system: ⇒ page 196 to ⇒ page 196 .

- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

Tightening torques

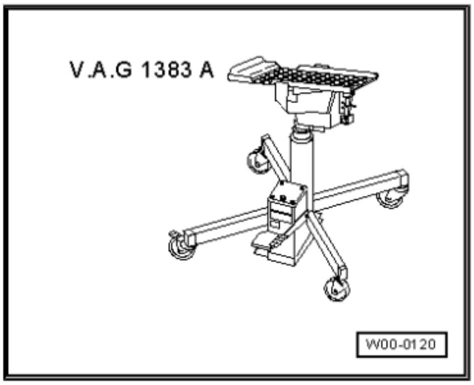
Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27 [25)]
Mounting bracket to front exhaust pipe	25
Mounting bracket to gearbox support	25
Drive shaft heat shield to gearbox	23
Front exhaust pipe to gearbox bracket	25 [25)]
Front cross member to body	23
Air duct to intake manifold	10

25) Renew nuts.

1.5 Removing and installing front exhaust pipe (right-side) with catalytic converter

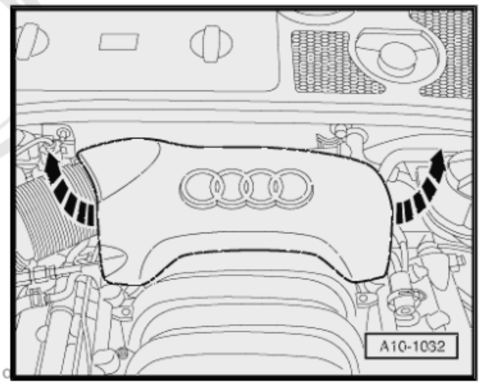
Special tools and workshop equipment required

- ♦ Engine/gearbox jack -V.A.G 1383 A-

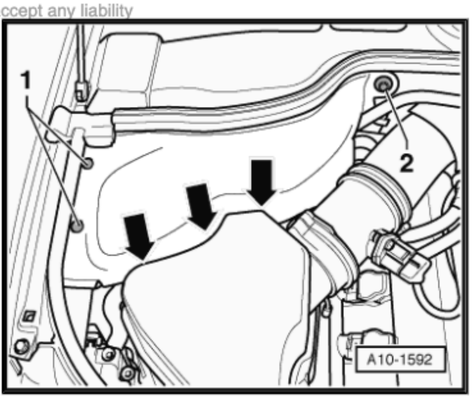


Removing

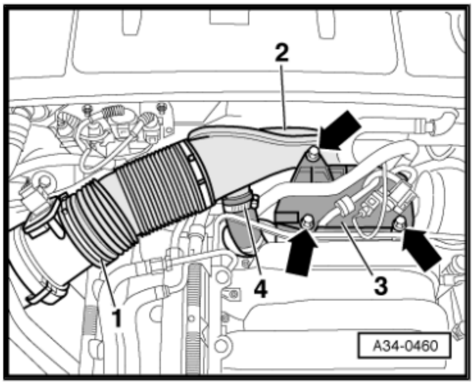
- – Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .
- – Pull off rear engine cover -arrows-.



- – Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.
- – Pull cover out of retainers -arrows-.



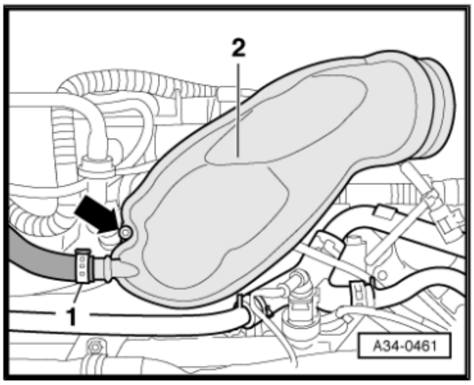
- – Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- – Detach air intake hose -1- at air mass meter -G70- .
- – Pull hose -4- off air duct -2-.



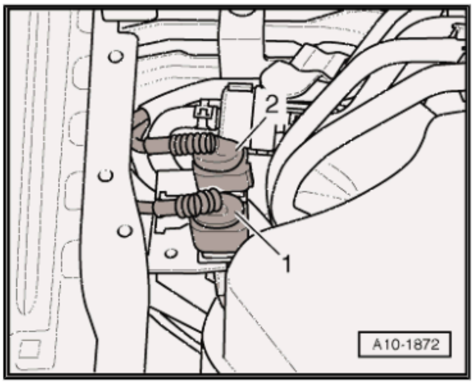
- Unscrew bolt -arrow- and disconnect air duct -2- from throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

Note

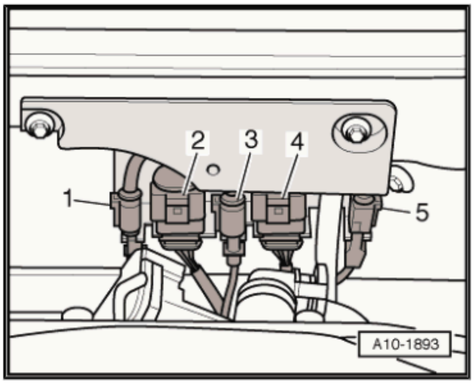
For illustration purposes, the air duct is shown from rear and with engine removed.



- Detach electrical connector -1- from bracket and unplug.



- Detach electrical connector -2- from bracket and unplug.
- Guide wiring for Lambda probes downwards.



- Unscrew nut -2- (accessible from above) connecting front exhaust pipe to exhaust manifold.

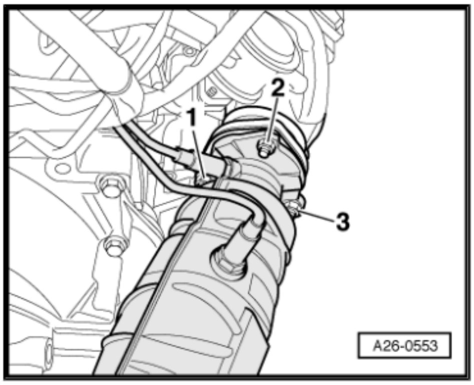
Note

Shown from rear with engine removed for illustration purposes.

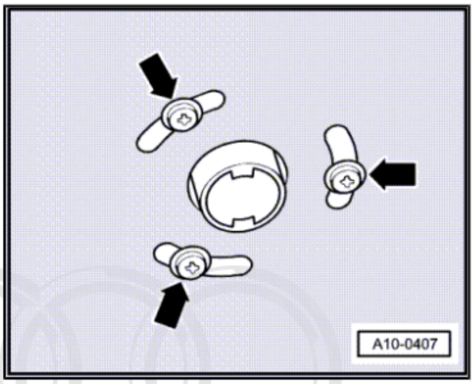
- Remove front right wheel.

Note

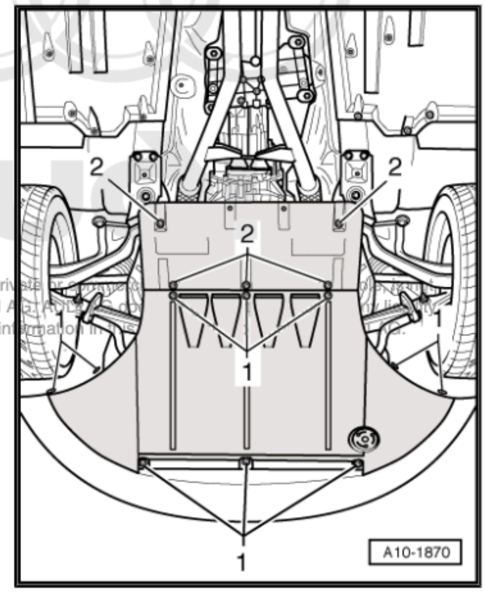
Secure brake disc with wheel bolts.



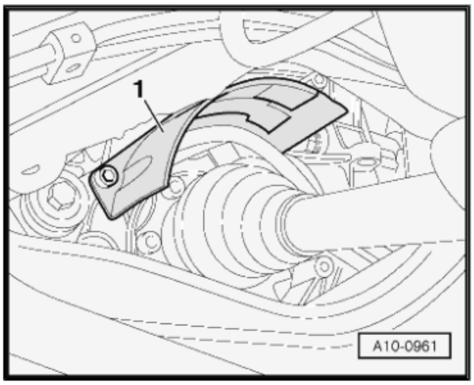
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



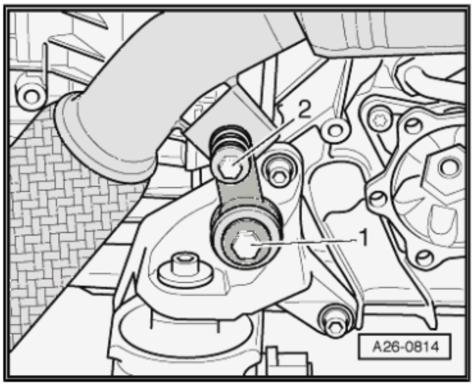
- Loosen quick release fasteners -1- and -2- and remove noise insulation parts.



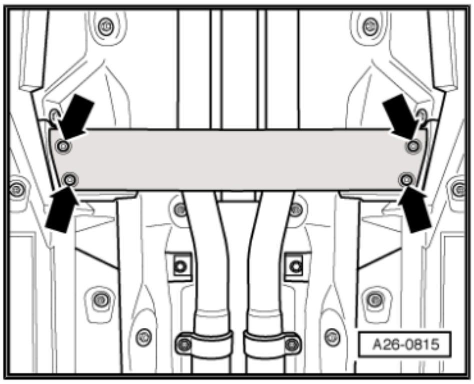
- Unbolt heat shield -1- for drive shaft (right-side).



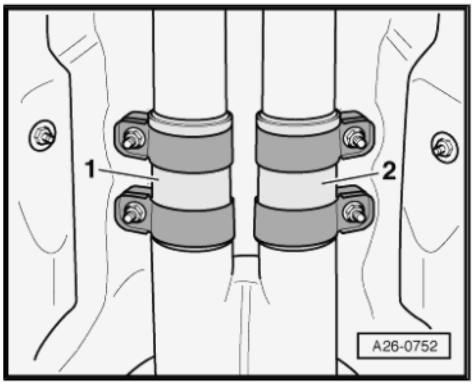
- Unscrew bolts -1- and -2- and remove bracket for front exhaust pipe.



- Remove front cross member -arrows-.



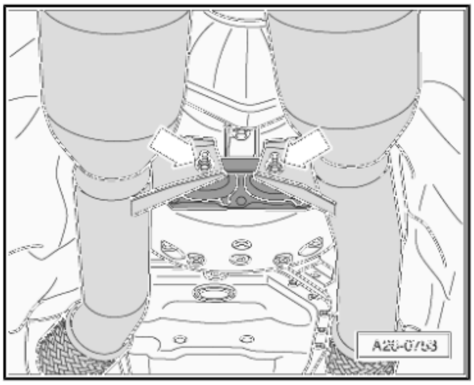
- Disconnect exhaust system at clamp (right-side) -2-.



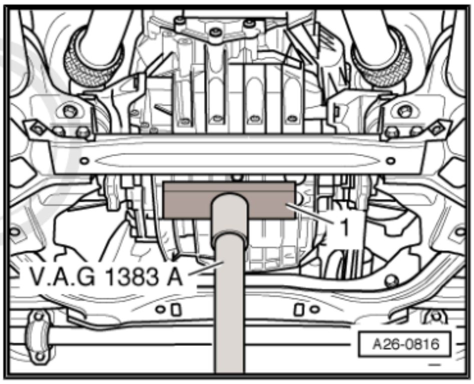
Note

The flexible joint in front exhaust pipe must not be bent more than 10 ° - damage can otherwise occur.

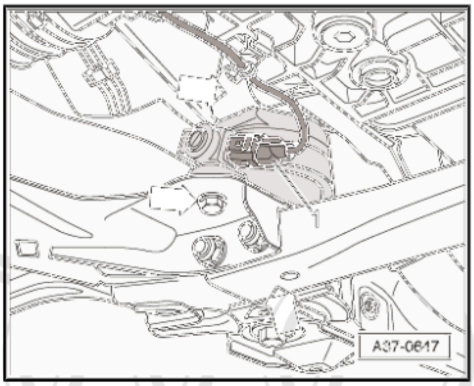
- Unscrew nut -right arrow- at mounting bracket for front exhaust pipe (right-side).



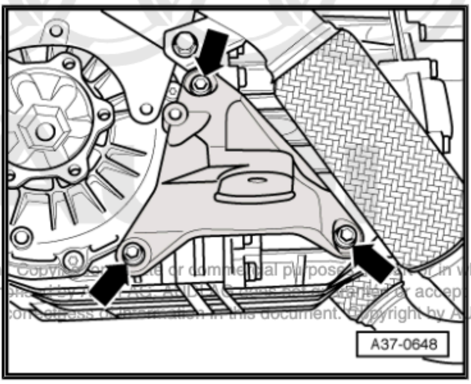
- Detach universal support -V.A.G 1359/2- from engine and gearbox jack -V.A.G 1383 A- and in their place put a wooden block -1- on the lifting arm.
- Using engine and gearbox jack -V.A.G 1383 A- and wooden block raise gearbox slightly.

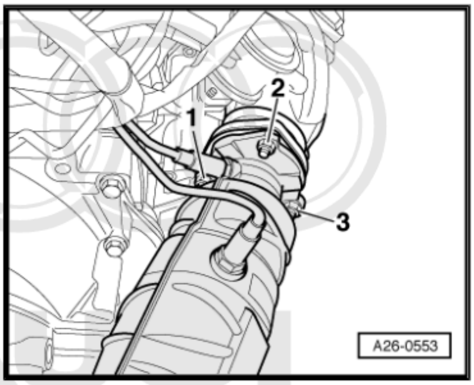


- Unplug electrical connector -1- at gearbox mounting (right-side).
- Unscrew bolts -arrows- and remove gearbox mounting (right-side).



- Unbolt gearbox support (right-side) -arrows-.
- Lower gearbox slightly, making sure the heat shield on the propshaft does not become damaged.





– Move Lambda probe wires clear.

– Unscrew nuts -1- and -3- (accessible from below) connecting front exhaust pipe to exhaust manifold.

Note

Shown in illustration with engine removed.

– Remove front exhaust pipe with catalytic converter.

Installing

Installation is carried out in the reverse order; note the following:

Note

- *Renew gaskets, O-ring and self-locking nuts.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Fit all cable ties in the original positions when installing.*
- *When installing, the Lambda probe wires must always be re-attached at the same locations to prevent them from coming into contact with the exhaust pipe.*

– Install gearbox support and gearbox mounting ⇒ multitronic 01J, front-wheel drive; Rep. Gr. 37 or ⇒ multitronic 01T, four-wheel drive; Rep. Gr. 37 .

– Align exhaust system so it is free of stress ⇒ page 215 .

Note

Mounting components for exhaust system: ⇒ page 196 to ⇒ page 196 .

– Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

Tightening torques

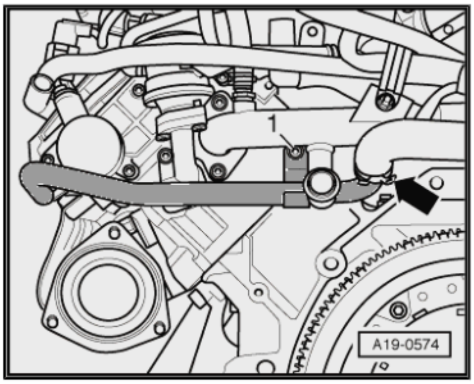
Component	Nm
Front exhaust pipe with catalytic converter to exhaust manifold	27 [26]
Mounting bracket to front exhaust pipe	25
Mounting bracket to gearbox support	25
Drive shaft heat shield to gearbox	23
Front exhaust pipe to gearbox bracket	25 [26]
Front cross member to body	23
Air duct to intake manifold	10

[26] Renew nuts.

1.6 Removing and installing exhaust manifold (left-side)

Removing

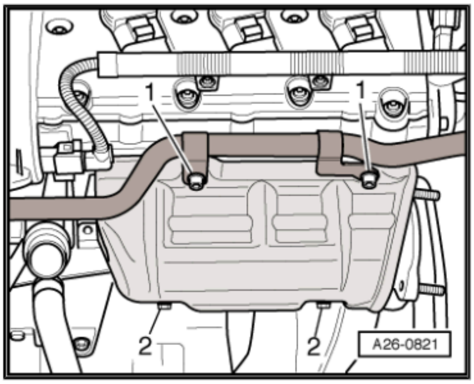
- Remove front exhaust pipe (left-side) together with catalytic converter ⇒ page 199 .
- Then re-install gearbox support and gearbox mounting, but only hand-tighten bolts.
- Unscrew bolt -1- at coolant pipe (rear left).

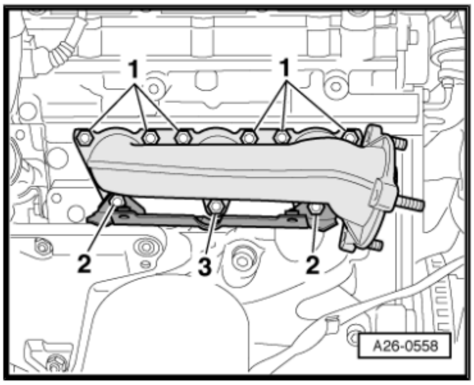


Note

Ignore -arrow-.

- Unscrew bolts -1- (accessible from above) at heat shield.
- Unscrew bolts -2- (accessible from below) and detach heat shield.





- Unscrew bolts -1- (accessible from above) on exhaust manifold.
- Unscrew nuts -2- (accessible from below) and detach bracket for heat shield.
- Unscrew nut -3- and detach exhaust manifold.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew gaskets and self-locking nuts.

- Install front exhaust pipe (left-side) together with catalytic converter ⇒ page 199 .
- Align exhaust system so it is free of stress ⇒ page 215 .

Tightening torques

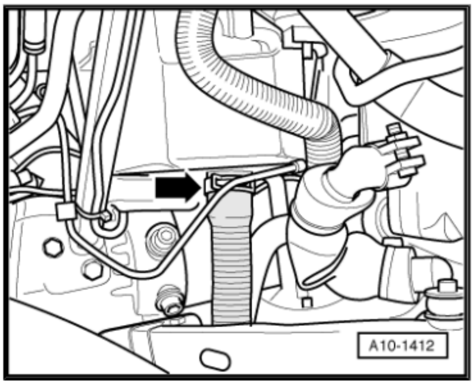
Component		Nm
Exhaust manifold to cylinder head		25 27)
Heat shield	M6	10
for exhaust manifold	M8	22
Coolant pipe (left-side) to cylinder head		10

27) Renew nuts.

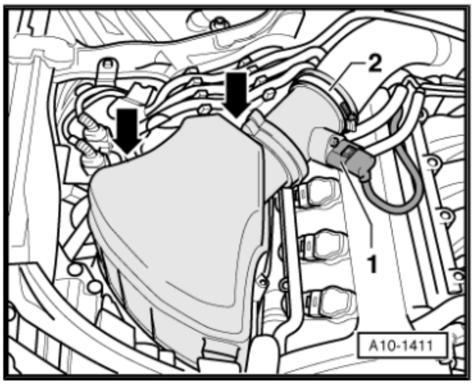
1.7 Removing and installing exhaust manifold (right-side)

Removing

- Remove front exhaust pipe (right-side) together with catalytic converter ⇒ page 205 .
- Then re-install gearbox support and gearbox mounting, but only hand-tighten bolts.
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



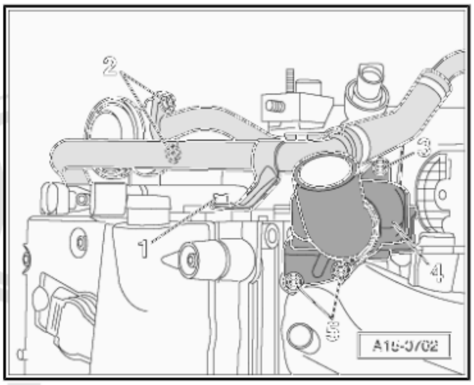
- Detach electrical connector -1-.
- Unscrew bolts -arrows- and remove air cleaner housing.



Note

Ignore item marked -2-.

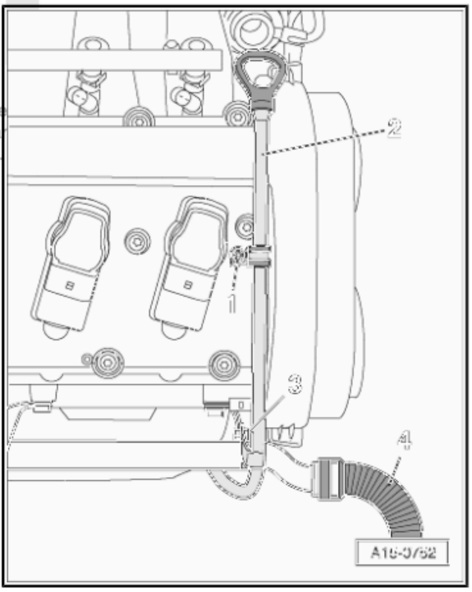
- Unscrew bolts -1- and -2- at secondary air pipes.



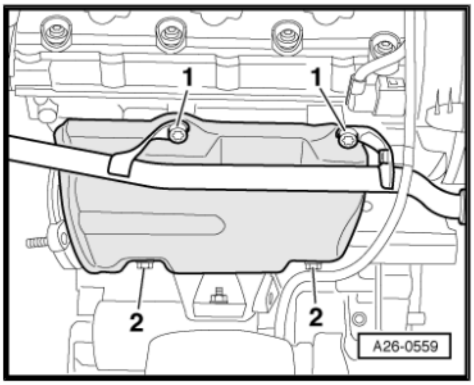
Note

The resonator -4- with bolts -3- and -5- remains installed.

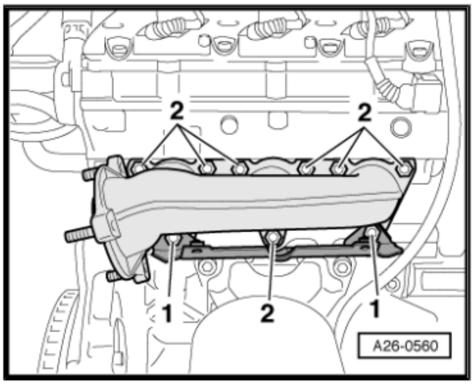
- Unscrew bolts -1- and -3-.
- Disconnect hose -4- at pipe for secondary air.
- Pull guide tube -2- for oil dipstick upwards out of top section of sump and fold forwards.



- Remove upper securing bolts -1-.
- Unscrew bolt -2- and remove heat shield.



- Unscrew nuts -1- and remove bracket for heat shield.
- Unscrew nuts -2- and detach exhaust manifold.



Installing

Installation is carried out in the reverse order; note the following:

Note

Renew gaskets and self-locking nuts.

- Install front exhaust pipe (right-side) together with catalytic converter ⇒ page 205 .
- Align exhaust system so it is free of stress ⇒ page 215 .

Tightening torques

Component		Nm
Exhaust manifold to cylinder head		25 [28]
Heat shield to bracket for heat shield		10
Pipe for	M6	10
secondary air	M8	22
Guide tube for oil dipstick to secondary air pipe		10

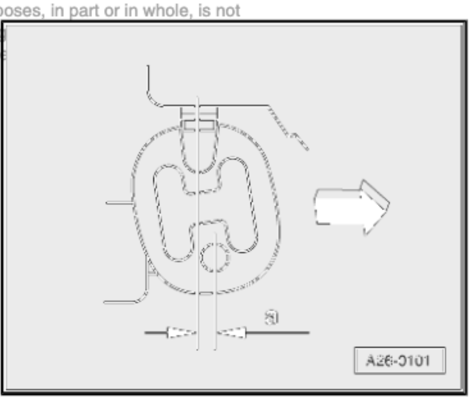
[28] Renew nuts.

1.8 Stress-free alignment of exhaust system

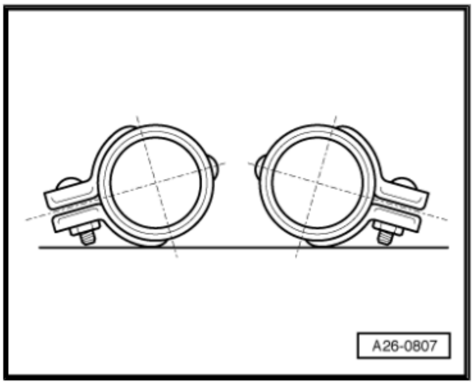
Note

The exhaust system must be aligned when it is cool.

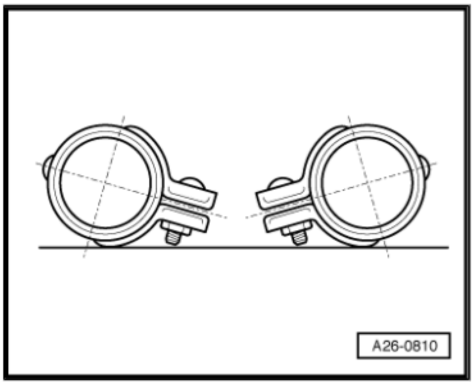
- Loosen bolt connections of all exhaust system clamps.
- Push rear silencers forwards -arrow- until pretension at rubber mountings reaches following specifications:
- Rubber mounting (front): -a- = 11 mm.
- Rubber mounting (rear): -a- = 14 mm.



- Position clamps so that they align with centre of cutting locations.
- Align front and middle clamps ...

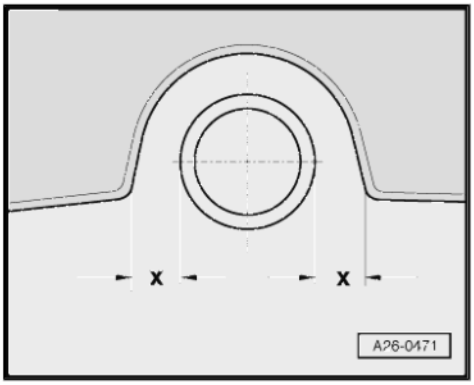


- ... as well as rear clamps, making sure that bolt ends do not protrude below bottom of clamp.
- Tighten bolt connections of clamps evenly to 23 Nm.

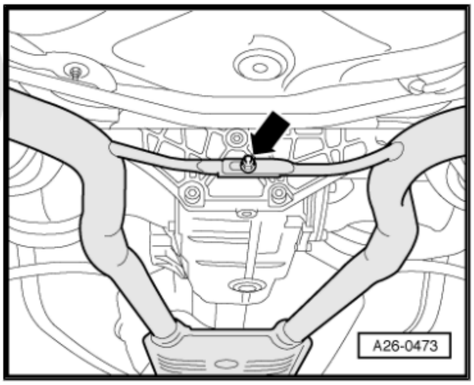


Aligning tailpipes

- Check clearance between tailpipes and bumper on both sides.
- Dimension -x- (left-side) = dimension -x- (right-side); tolerance max. 2 mm.
- If necessary, correct dimension -x- ...,

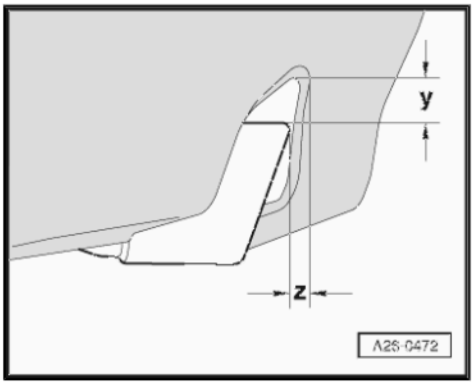


- ... by loosening nut -arrow- on strut between exhaust pipes.
- Adjust the distance between the rear silencers.
- Tighten nut to 23 Nm.



- Check distances -y- and -z- between tailpipes and bumper.

- Dimension -y- = 18 ... 22 mm.
- Dimension -z- = 8 ... 12 mm.



1.9 Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes during leak test (e.g. with cloth or plug).
- Listen for noise at connection points (cylinder head/exhaust manifold, exhaust manifold/front exhaust pipe, etc.) to locate any leaks.
- Repair any leaks that are discovered.

2 Servicing secondary air system

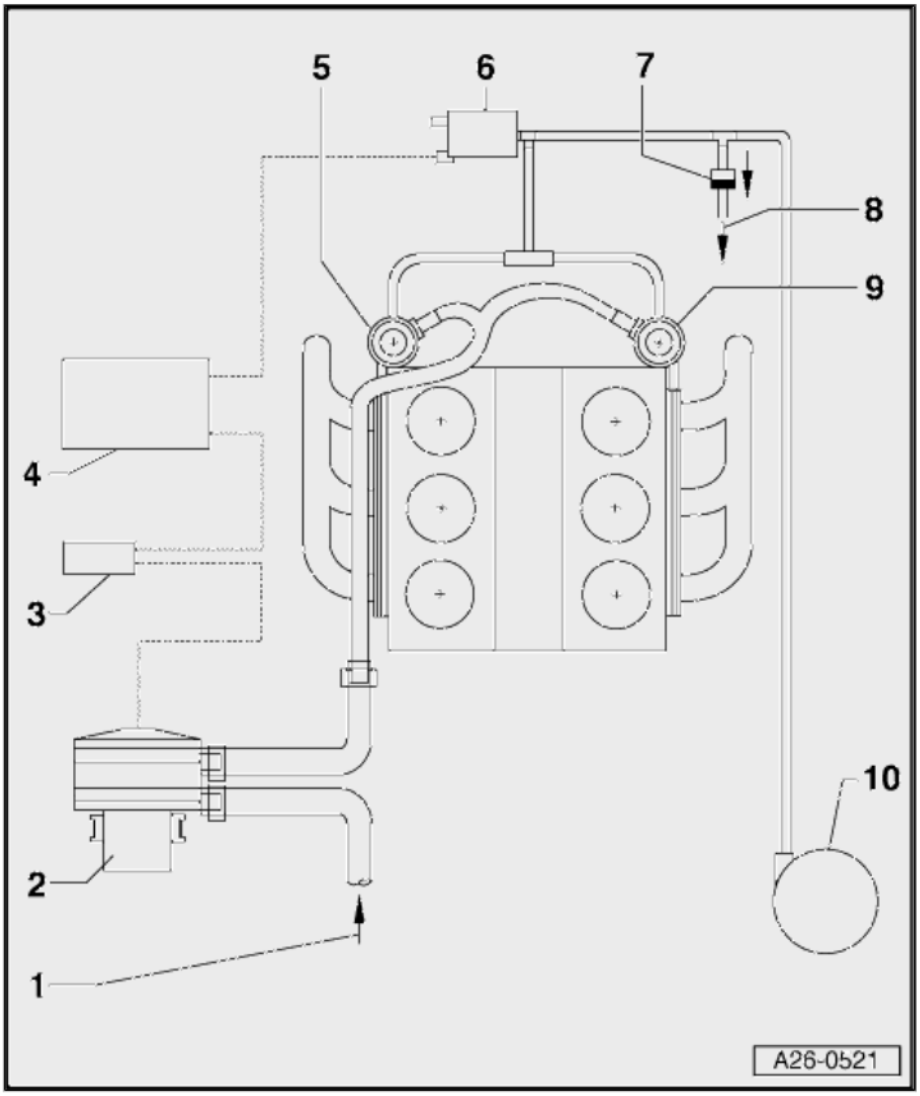
The secondary air system is designed to enable the catalytic converter to heat up and reach its operating temperature more quickly after a cold start.

2.1 Principle and function

Principle

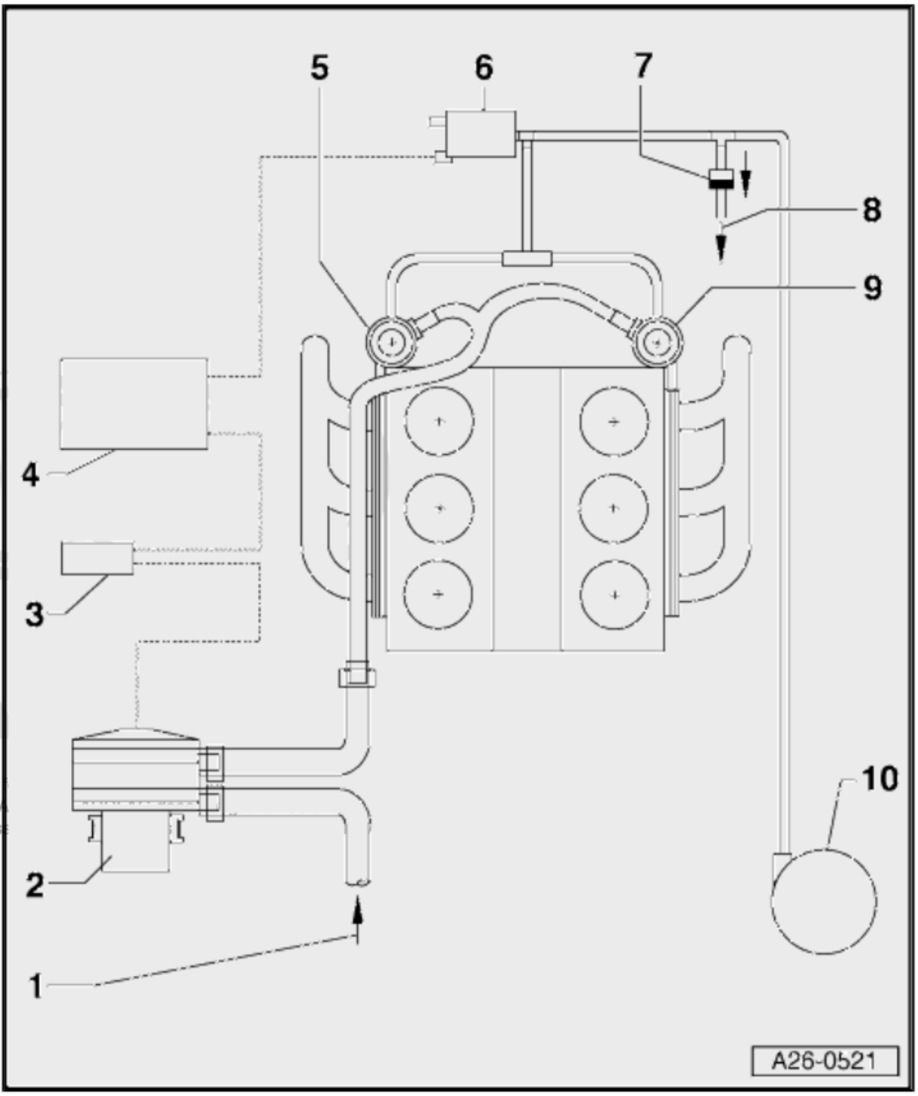
Because of the over-enrichment of the mixture in the cold start phase, the percentage of unburned hydrocarbons in the exhaust gas is higher. The injection of secondary air improves the post-oxidation in the catalytic converter and thus reduces pollutant emissions. The heat produced by the post-oxidation considerably shortens the start-up time of the catalytic converter and significantly enhances the emission quality in the cold-running phase.

Function



- In the cold-running phase the engine control unit -J623- -Item 4- activates the secondary air pump motor -V101- -Item 2- via the secondary air pump relay -J299- -Item 3-. Air will then reach the combination valves for secondary air system -5- and -9-.

◆ At the same time, the secondary air inlet valve -N112- -Item 6- will be activated, allowing vacuum pressure to reach the combination valves for secondary air system -5- and -9-. In this way, the combination valve opens a passage for the secondary air system to supply air to the exhaust ports in the cylinder head.



1 - From air cleaner housing

2 - Secondary air pump motor -V101-

- ☐ Fitting location ⇒ page 220
- ☐ Removing and installing ⇒ page 231

3 - Secondary air pump relay -J299-

- ☐ Fitting location ⇒ page 220

4 - Engine control unit -J623-

5 - Combination valve for secondary air (right-side)

- ☐ Fitting location ⇒ page 220
- ☐ Checking ⇒ page 232
- ☐ Removing and installing ⇒ page 236

6 - Secondary air inlet valve -N112-

- ☐ Fitting location ⇒ page 220

7 - Non-return valve

- ☐ Installation position (light side/dark side) as shown in illustration. Arrow indicates direction of flow.

8 - To intake manifold

9 - Combination valve for secondary air (left-side)

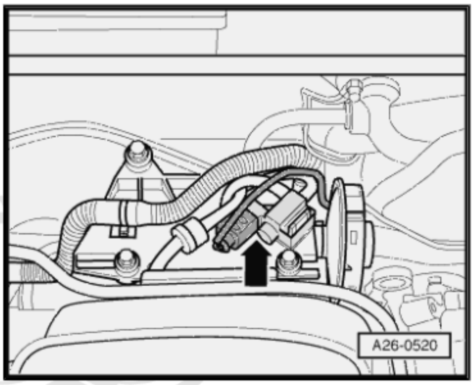
- ☐ Fitting location ⇒ page 220
- ☐ Checking ⇒ page 232
- ☐ Removing and installing ⇒ page 235

10 - Vacuum reservoir

- ☐ Fitting location: in front left wheel housing beneath liner

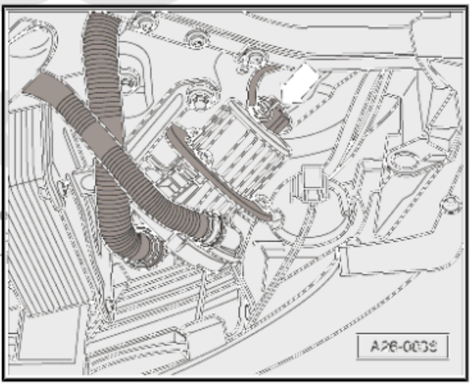
Fitting location of secondary air inlet valve -N112-

- ♦ Inserted on retainer plate for solenoid valves at rear of engine -arrow-.



Fitting location of secondary air pump motor -V101-

- ♦ On longitudinal member (right-side, bottom) -arrow-.

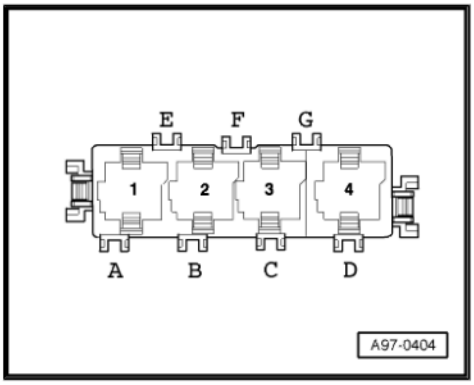


Fitting location of secondary air pump relay -J299- and secondary air pump fuse -S130-

- ♦ In electronics box (plenum chamber).

1 - Secondary air pump relay -J299-

B - Secondary air pump relay -S130- (50 amp)

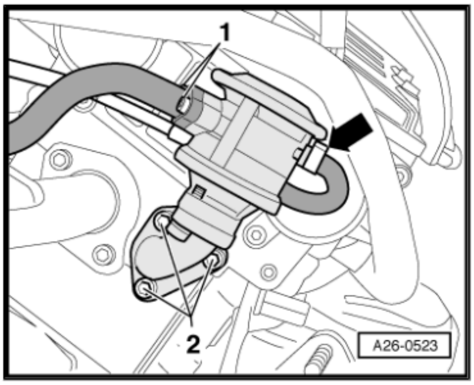


Combination valve for secondary air

- ♦ At rear of cylinder heads.

Note

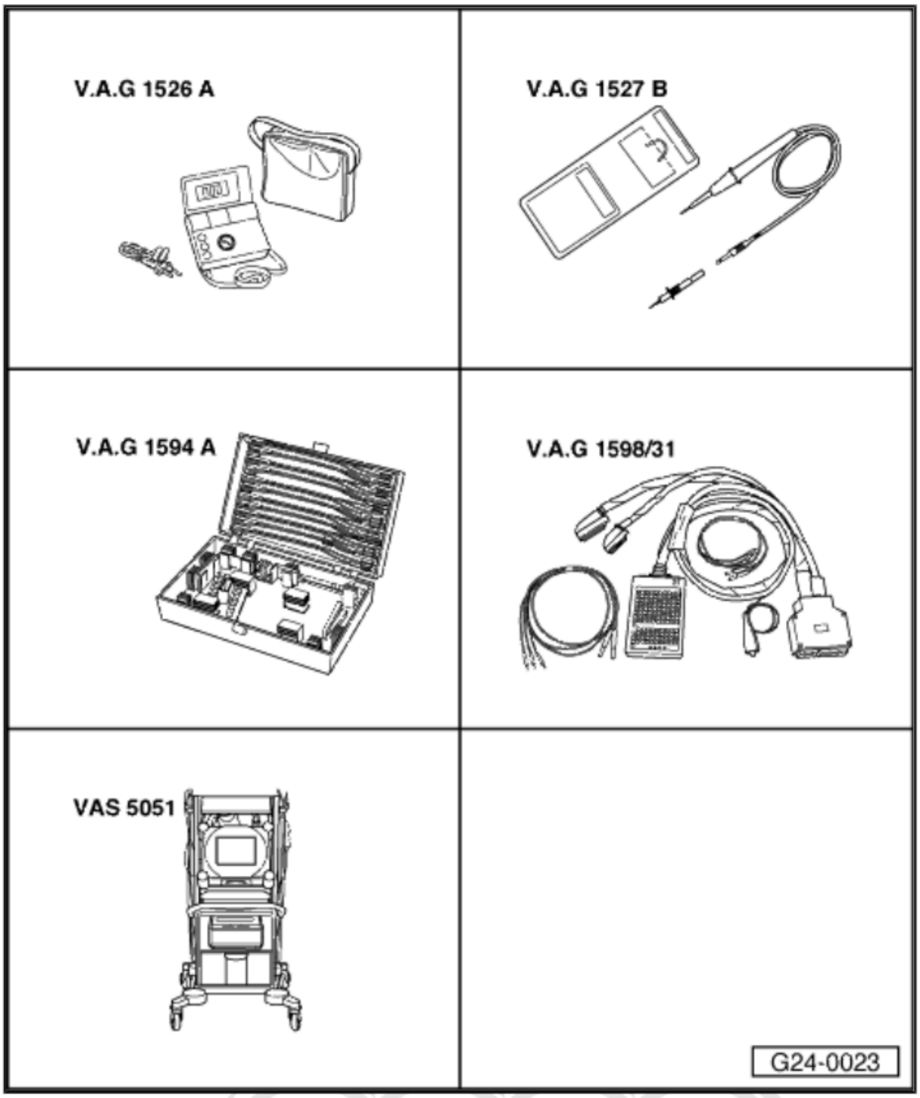
Illustration shows valve on right side.



2.2 Checking secondary air inlet valve -N112-

Special tools and workshop equipment required

- ♦ Hand-held multimeter -V.A.G 1526 A-
- ♦ Voltage tester -V.A.G 1527 B-
- ♦ Adapter set -V.A.G 1594 A-
- ♦ Test box -V.A.G 1598/31-
- ♦ Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A-



Test sequence

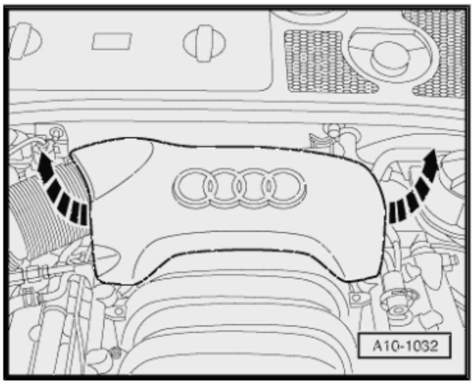
The secondary air inlet valve -N112- and the wiring connections are monitored by the engine control unit.

- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.

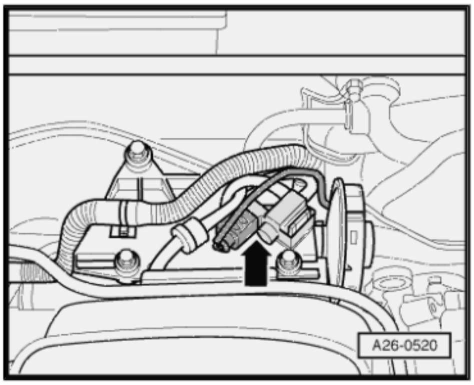
– Read out fault memory of engine control unit.

If a fault relating to secondary air inlet valve -N112- is displayed:

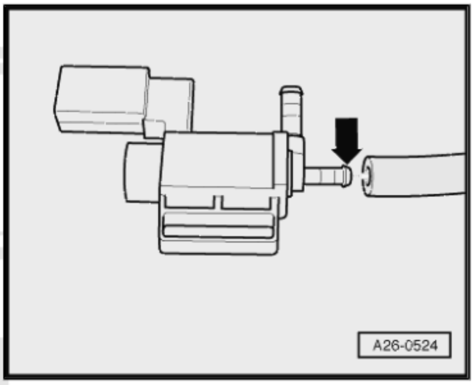
– Pull off rear engine cover -arrows-.



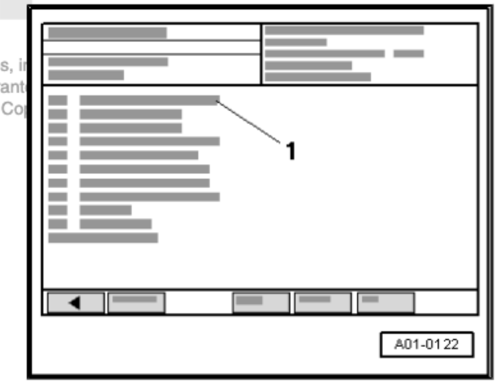
– Disconnect hoses from secondary air inlet valve -N112- -arrow-; leave electrical connector attached.



– Connect auxiliary hose to the valve connector marked with an arrow.



- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.



– Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.

– Press the button → until the secondary air inlet valve -N112- is actuated.

- The valve should click ...

- ... and should open and close (check by blowing into the auxiliary hose).

– Exit function “03 - Final control diagnosis” by pressing the ← key.

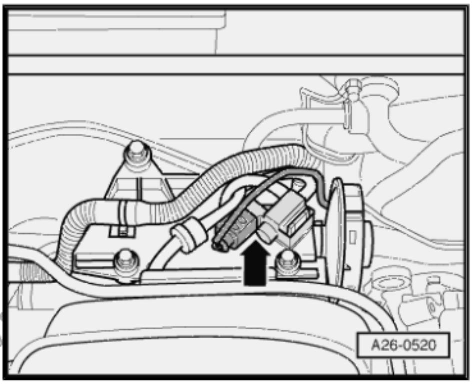
– Switch off ignition.

If valve does not open or close correctly:

– Renew secondary air inlet valve -N112- .

Checking internal resistance

- Unplug connector from secondary air inlet valve -N112- -arrow-.

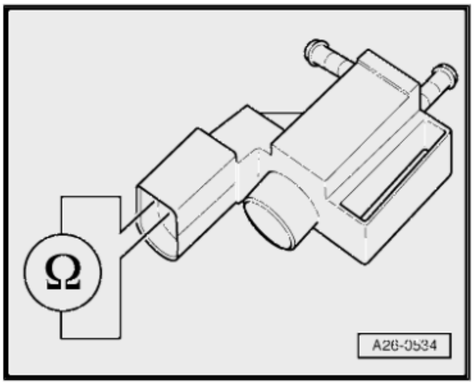


- Connect multimeter (resistance measuring range) to valve.

- Specification: 25 ... 35 Ω

If the specification is not attained:

- Renew secondary air inlet valve -N112- .



Checking voltage supply

Note

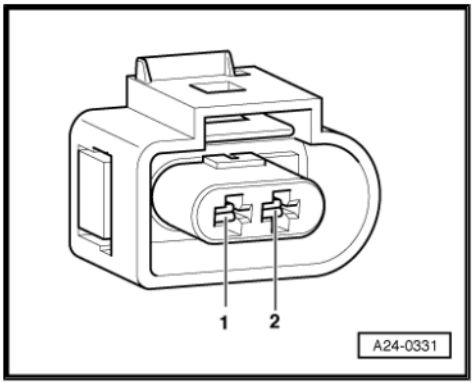
- *Fuse for secondary air inlet valve OK. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.*
- *Fuel pump relay OK.*

Note

The secondary air inlet valve -N112- receives its power supply via the fuel pump relay.

- Connect voltage tester -V.A.G 1527 B- as follows:

Connector Contact	Measure against
-1-	Engine earth



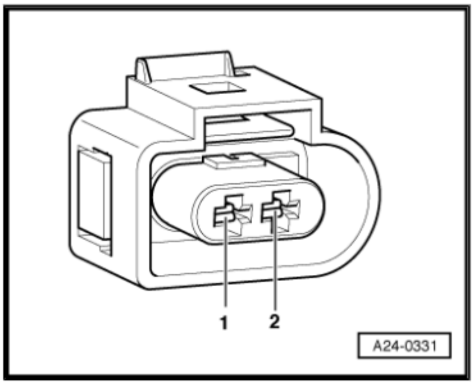
- Operate the starter briefly.
- The LED should light up.
- Switch off ignition.

If the LED does not light up:

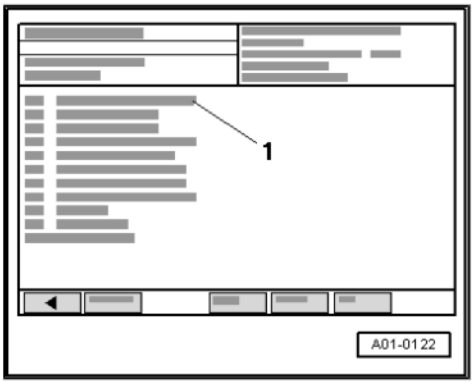
- Use current flow diagram to check for open circuit in wiring from contact 1 of connector via fuse to fuel pump relay -J17- .
- If necessary repair wiring connection.

Checking activation

- Connect voltage tester - V.A.G 1527 B- to contacts -1- (plus) and -2- of the connector.



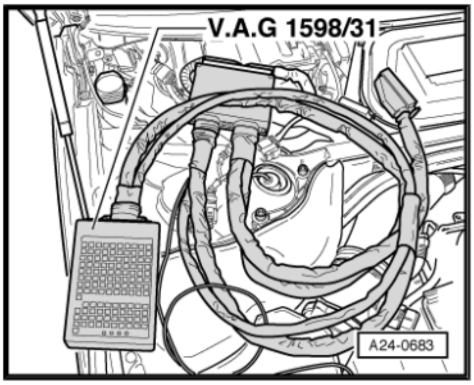
- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.



- Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.
- Press the button → until the secondary air inlet valve -N112- is actuated.
- The LED should flash.
- Exit function “03 - Final control diagnosis” by pressing the ← key.
- Switch off ignition.

If the LED lamp does not flash or lights up continuously:

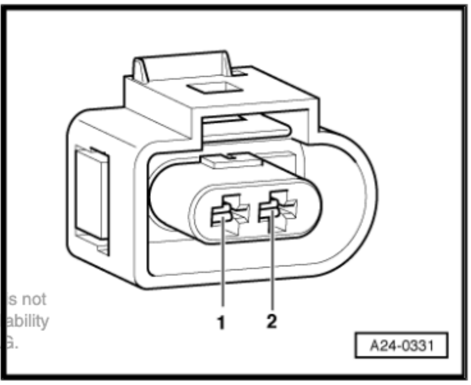
- Connect test box -V.A.G 1598/31- to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24 .



- Check for open circuit and short to positive or earth in the following wiring:

Connector Contact	Test box - V.A.G 1598/31- Socket
-2-	44

- If necessary repair wiring connection.



2.3 Checking secondary air pump relay -J299- and activation

Special tools and workshop equipment required

- Hand-held multimeter -V.A.G 1526 A-
- Voltage tester -V.A.G 1527 B-
- Adapter set -V.A.G 1594 A-
- Test box -V.A.G 1598/31-
- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A-

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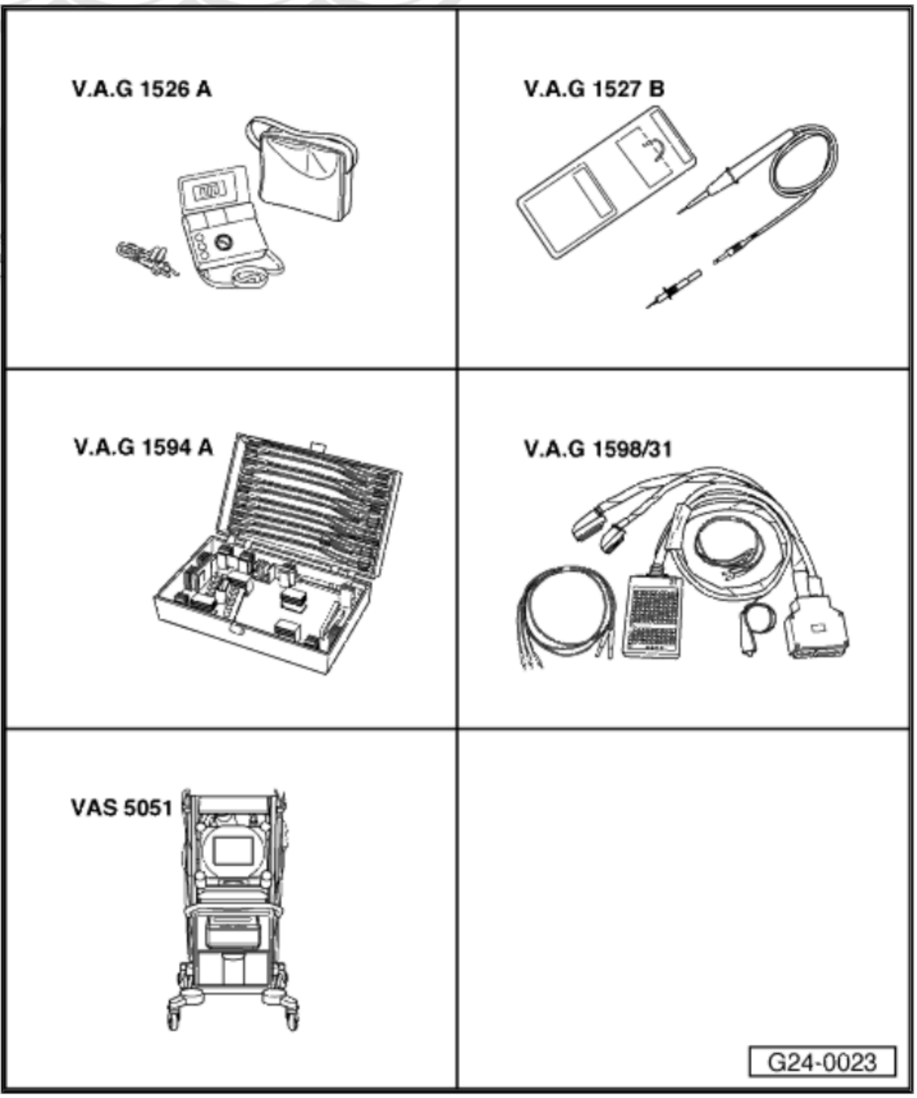
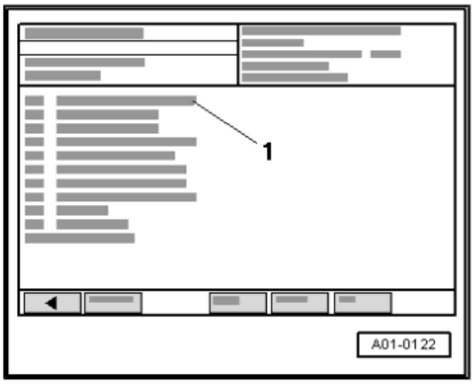


Test sequence

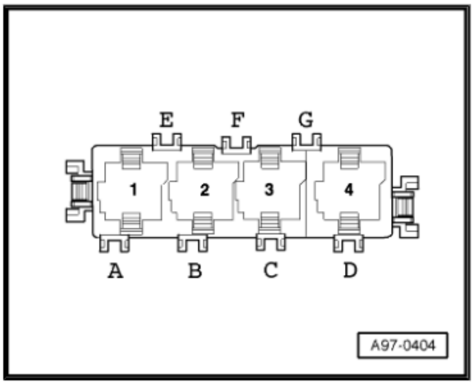
- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.

– Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.

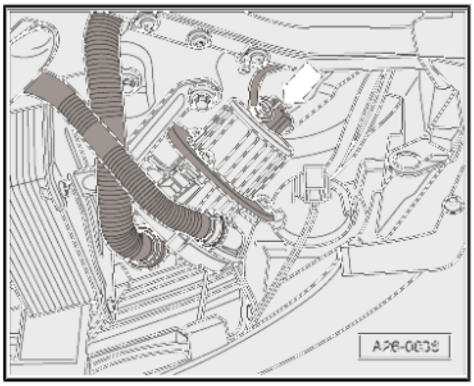


– Press the button → until the secondary air pump relay -J299- is actuated.

- The secondary air pump relay -J299- -Item 1- on relay carrier in electronics box (plenum chamber) should pick up (click) intermittently ...



- ... and the secondary air pump motor -V101- -arrow- should run intermittently.



– Exit function “03 - Final control diagnosis” by pressing the ← key.

– Switch off ignition.

A - If the relay does not pick up:

– Checking voltage supply of secondary air pump relay -J299- ⇒ page 226 .

– Check activation of secondary air pump relay ⇒ page 228 .

B - If the relay picks up but the secondary air pump motor -V101- does not run:

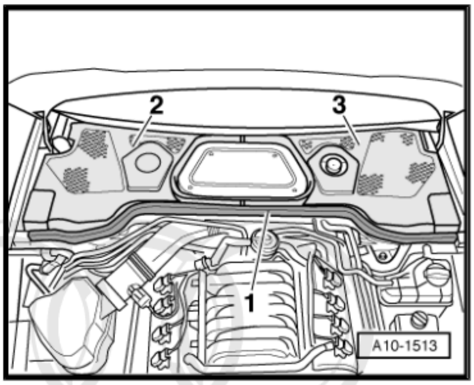
– Check voltage supply of secondary air pump motor -V101- ⇒ page 229 .

2.4 Checking voltage supply of secondary air pump relay -J299- .

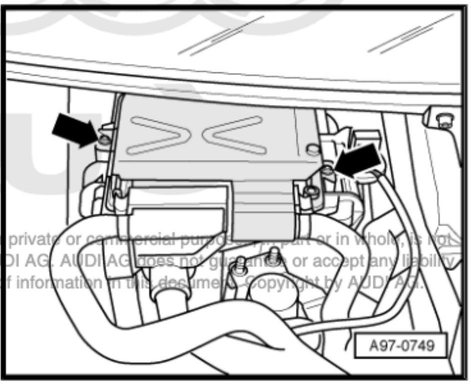
– Detach plenum chamber cover (right-side) -2-.

Note

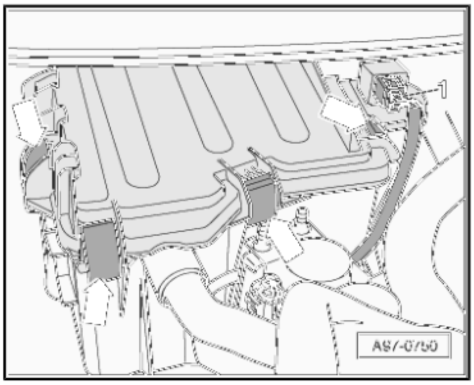
Ignore items marked -1- and -3-.



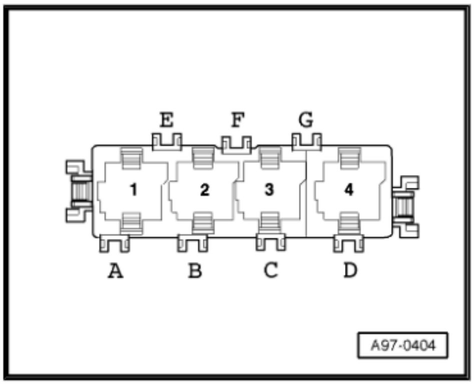
– Unscrew bolts -arrows- and pull out engine control unit towards front.



- Turn air quality sensor -G238- -Item 1- 90° anti-clockwise and detach it from bracket.
- Release retaining clips -arrows-.
- Open electronics box (plenum chamber) cover slightly and pull off to front.



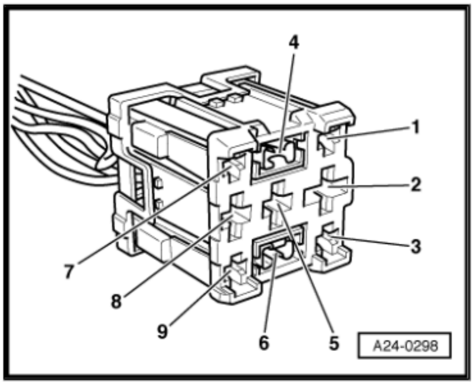
- Disconnect secondary air pump relay -J299- -Item 1-.



- Connect multimeter (voltage measurement range) as follows:

Relay carrier, electronics box (plenum chamber), position 1 contact	Measure against
-2-	Engine earth

- Specification: approx. battery voltage



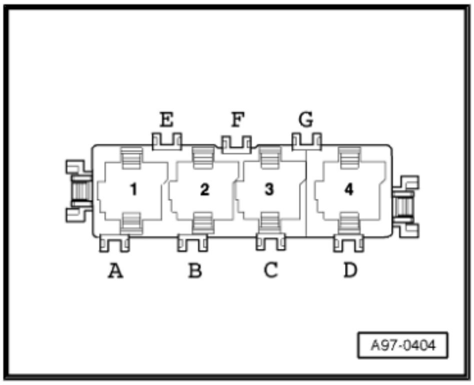
If specification is not reached:

- Carry out the following checks:

◆ Check secondary air pump fuse -S130- (50 A) -Item B- on relay carrier in electronics box (plenum chamber).

◆ Use current flow diagram to check for open circuit in wiring connection leading from battery-+ (terminal 30), via secondary air pump fuse -S130- , to secondary air pump relay -J299- -Item 1- on relay carrier in electronics box (plenum chamber) .

- If necessary repair wiring connection.



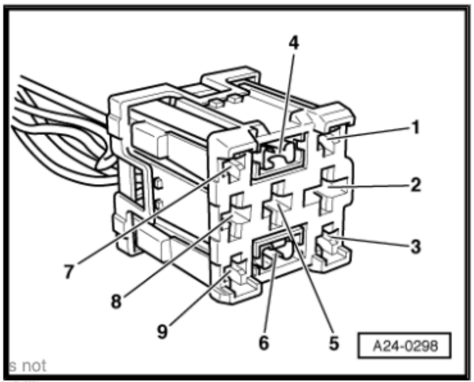
– Connect multimeter (voltage measurement range) as follows:

Relay carrier, electronics box (plenum chamber), position 1 contact	Measure against
-6-	Engine earth

– Operate the starter briefly.

- Specification: approx. battery voltage

– Switch off ignition.



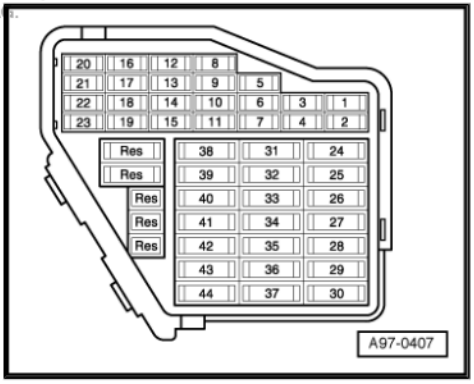
If specification is not reached:

– Carry out the following checks:

◆ Check fuse -SC 5- , position -5- on fuse carrier in dash panel (right-side).

◆ Use current flow diagram to check for open circuit in wiring connection leading from relay for secondary air pump -J299- (on relay carrier in electronics box, plenum chamber), via fuse -SC 5- (position -5- on fuse carrier in dash panel (right-side), to fuel pump relay -J17-

– If necessary repair wiring connection.

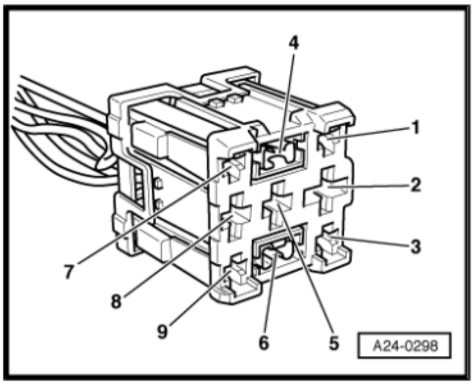


2.5 Checking activation of secondary air pump relay

- Secondary air pump relay -J299- disconnected.

– Connect voltage tester -V.A.G 1527 B- as follows:

Relay carrier, electronics box (plenum chamber), position 1 contact	Measure against
-4-	Engine earth



- Vehicle diagnostic, testing and information system - VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.

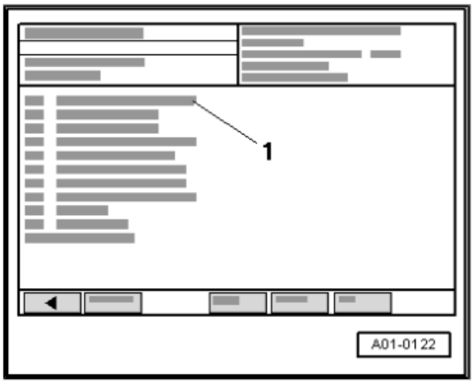
– Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.

– Press the button → until the secondary air pump relay -J299- is actuated.

- The LED should flash.

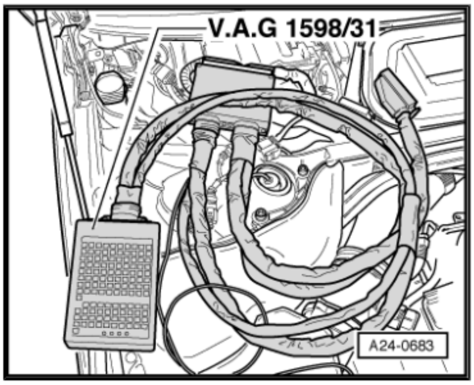
– Exit function “03 - Final control diagnosis” by pressing the ← key.

– Switch off ignition.



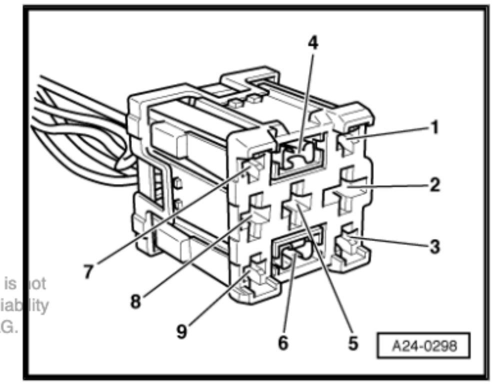
If the LED does not flash:

– Connect test box - V.A.G 1598/31- to connectors of wiring harness; do not connect engine control unit. Connect earth clip of test box to earth ⇒ Motronic injection and ignition system (6-cyl.); Rep. Gr. 24 .



– Check for open circuit and short to positive or earth in the following wiring:

Relay carrier, electronics box (plenum chamber), position 1 contact	Test box -V.A.G 1598/31- Socket
-4-	46



– If necessary repair wiring connection.

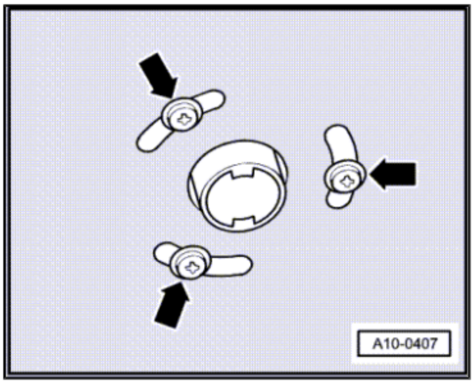
If no fault is found:

– Renew secondary air pump relay -J299- .

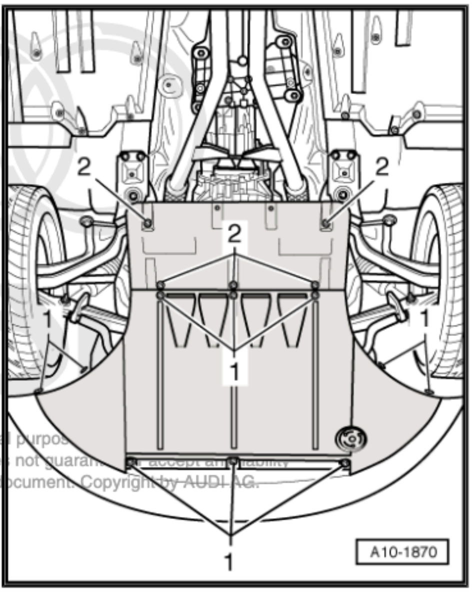
2.6 Checking voltage supply of secondary air pump motor -V101-

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

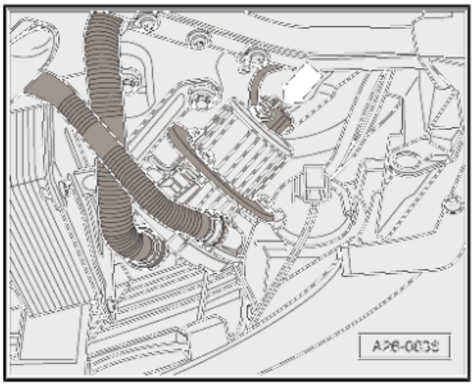
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



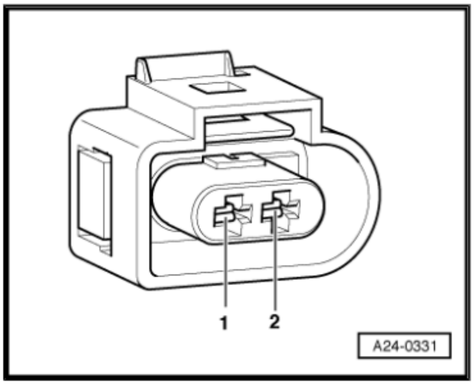
- Release fasteners -1- and remove front noise insulation.



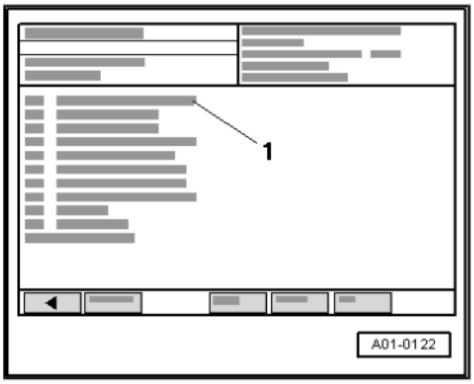
- Unplug electrical connector -arrow- at secondary air pump motor -V101- .



- Connect voltage tester -V.A.G 1527 B- between contacts -1- and -2-.



- Vehicle diagnostic, testing and information system -VAS 5051 A- with diagnosis lead -VAS 5051/5A- is connected; vehicle self-diagnosis and vehicle system “01 - Engine electronics” is selected. For this purpose, the ignition must be switched on.



– Under selection menu -1- select the diagnostic function “03 - Final control diagnosis”.

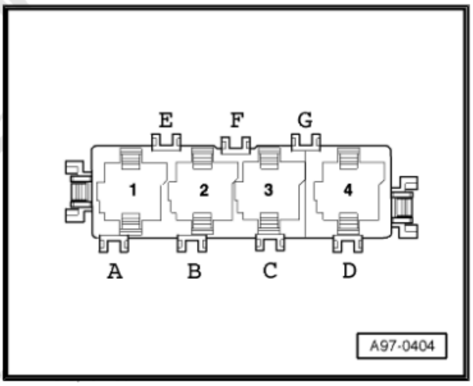
– Press the button → until the secondary air pump relay -J299- is actuated.

- The LED should flash.

– Exit function “03 - Final control diagnosis” by pressing the ← key.

– Switch off ignition.

If the LED does not flash:



– Carry out the following checks:

◆ Use current flow diagram to check for open circuit in wiring leading from contact 2 of connector going to secondary air pump relay -J299- on relay carrier in electronics box (plenum chamber), position -2-.

◆ Use current flow diagram to check for open circuit in wiring leading from contact 1 of connection to earth.

– If necessary repair wiring connection.

If no fault is found:

– Renew secondary air pump motor -V101- .

Additional steps required:

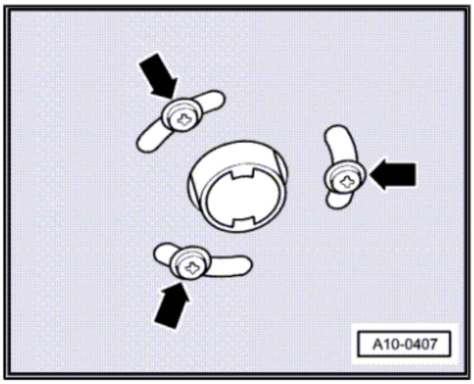
– Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

2.7 Removing and installing secondary air pump motor -V101-

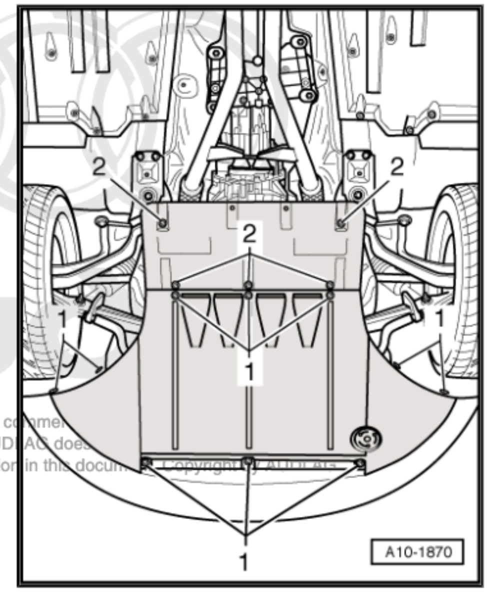
Removing

– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

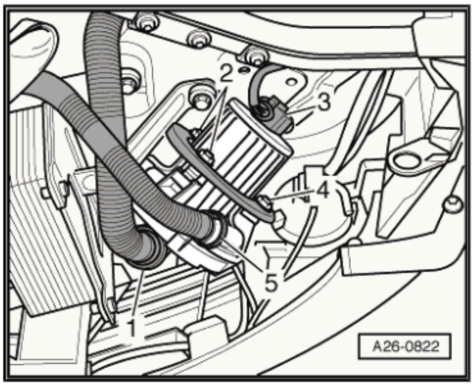
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



- Release fasteners -1- and remove front noise insulation.



- Detach air hoses -1- and -5-.
- Detach electrical connector -3-.
- Unscrew nuts -2- and -4- and detach secondary air pump motor -V101- from bracket.



Installing

Installation is carried out in the reverse order; note the following:

- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

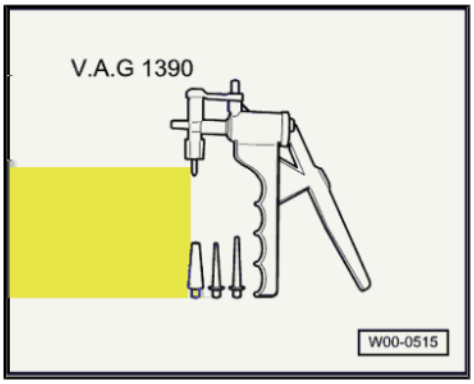
Tightening torque

Component	Nm
Secondary air pump motor -V101- to bracket	10

2.8 Checking combination valve for secondary air system for proper operation and leakage

Special tools and workshop equipment required

- ♦ Hand-operated vacuum pump -V.A.G 1390-



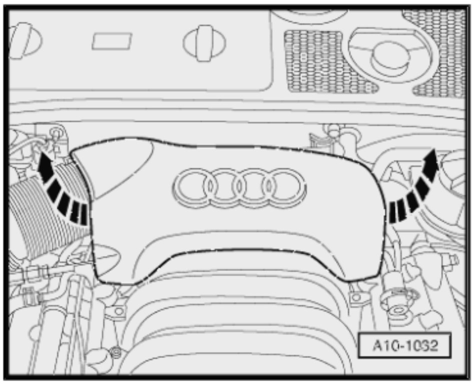
Test conditions

- Vacuum hoses and hose connections do not leak.
- Vacuum hoses are not clogged.

Test sequence

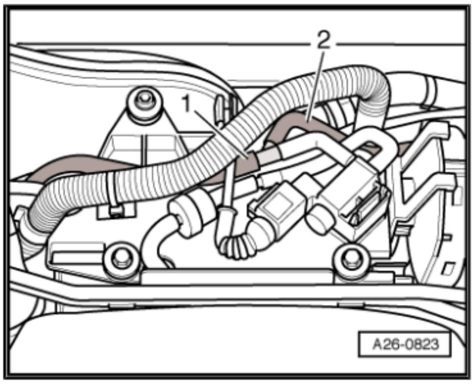
– Activate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

– Pull off rear engine cover -arrows-.

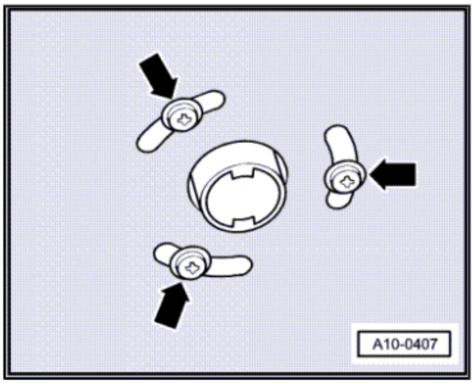


– Disconnect vacuum hose -1- or -2- from combination valve you want to test at Y-piece.

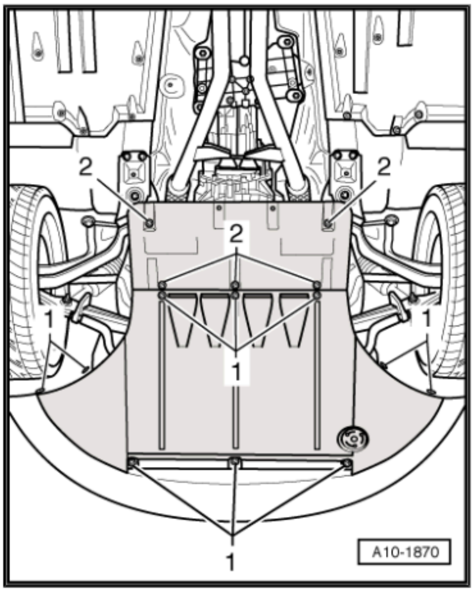
– Connect the hand vacuum pump -V.A.G 1390- to vacuum hose of combination valve you want to check.



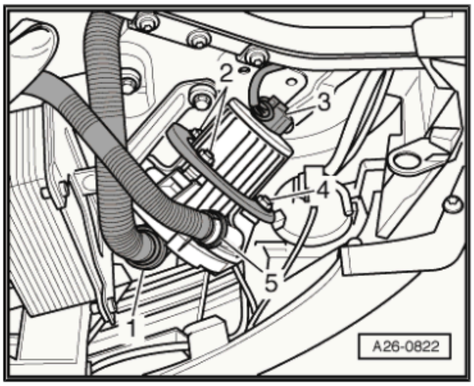
– Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



- Release fasteners -1- and remove front noise insulation.



- Detach pressure hose -5- from secondary air pump motor -V101- and blow into it with light pressure (do not use compressed air).



Note

Ignore -Items 1 ... 4-.

- Both combination valves must be closed and it must not be possible to blow through the hose.

- Operate the hand vacuum pump.

- The combination valve should open; it should now be possible to blow through the hose.

If combination valve does not open:

- Renew combination valve for secondary air system: on left-side ⇒ page 235 , on right-side ⇒ page 236 .

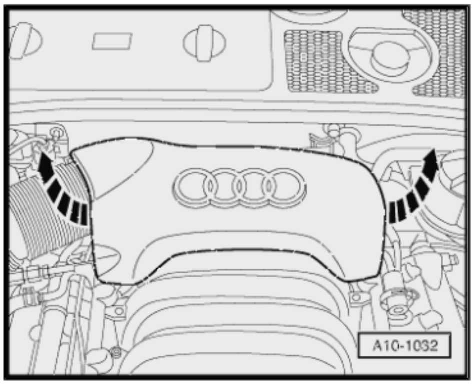
Additional steps required:

- Deactivate jacking mode ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 43 ; Operating the air suspension .

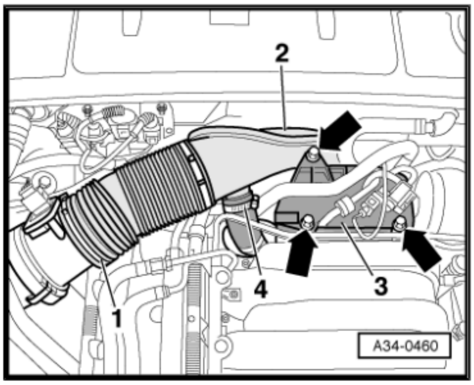
2.9 Removing and installing combination valve for secondary air system (left-side)

Removing

- Pull off rear engine cover -arrows-.



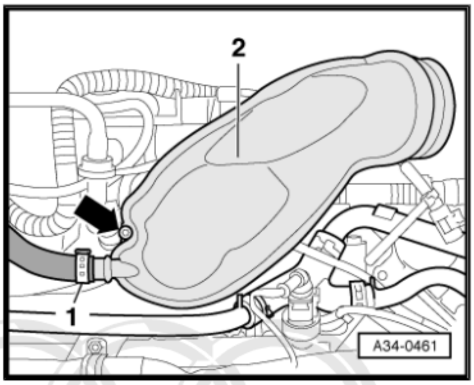
- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Detach air intake hose -1- at air mass meter -G70- .
- Pull hose -4- off air duct -2-.



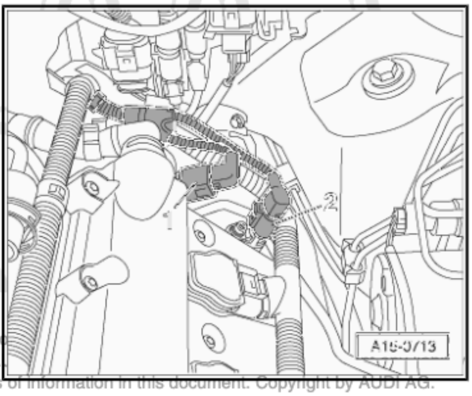
- Unscrew bolt -arrow- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

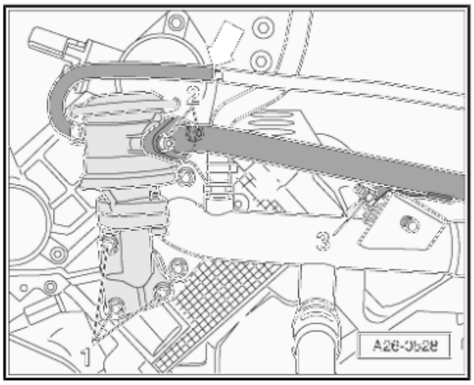
Note

For illustration purposes, the air duct is shown from rear and with engine removed.



- Unplug electrical connectors -1- and -2- at Hall senders -G163- and -G301- .
- Disconnect crankcase breather hose -3- at cylinder head cover.
- Remove heat shield for connections from bulkhead (left-side).





- Unscrew bolts -1- on flange of combination valve for secondary air.
- Loosen nut -3- in several turns.
- Unscrew bolts -2- and detach vacuum hose -arrow-.
- Detach combination valve.

Note

Shown from rear with engine removed for illustration purposes.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.

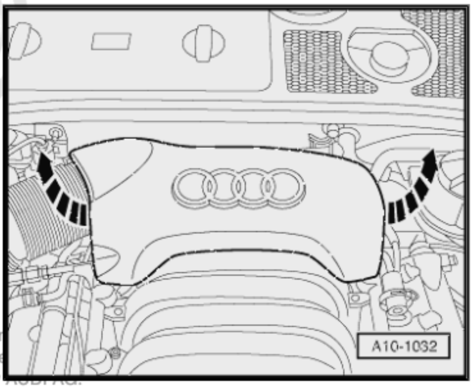
Tightening torques

Component		Nm
Combination valve to cylinder head		10
Connecting pipe to	Combination valve	10
	Coolant pipe	10

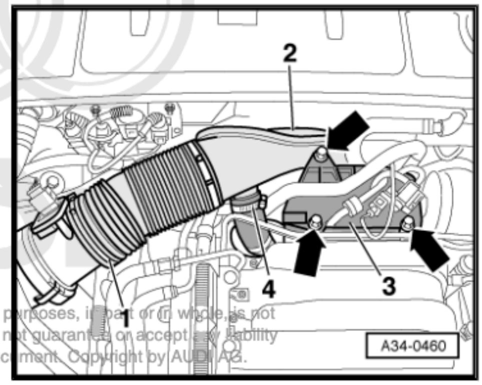
2.10 Removing and installing combination valve for secondary air system (right-side)

Removing

- Pull off rear engine cover -arrows-.



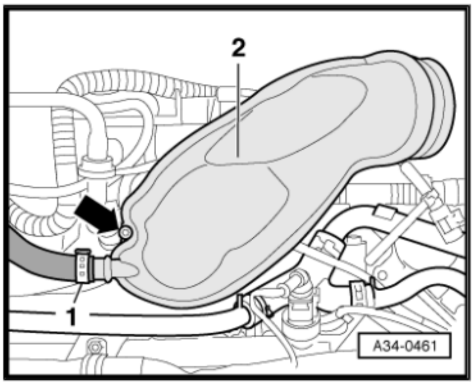
- Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).
- Detach air intake hose -1- at air mass meter -G70- .
- Pull hose -4- off air duct -2-.



- Unscrew bolt -arrow- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

Note

Illustration shows air duct from rear with engine removed.



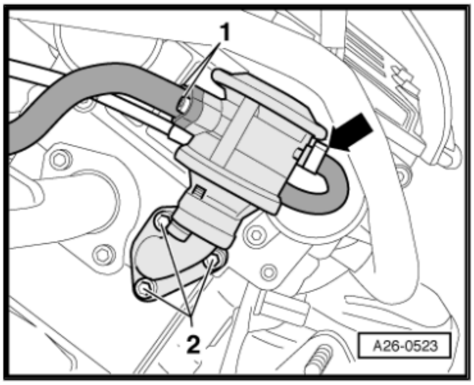
- Unscrew bolts -1- and -2- and detach combination valve.
- Detach vacuum hose -arrow-.

Installing

Installation is carried out in the reverse order; note the following:

Note

Renew seals and gaskets.



Tightening torques

Component	Nm
Combination valve to cylinder head	10
Connecting pipe to combination valve	10

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00 – Technical data

1 Safety precautions

(ARL003707; Edition 02.2014)

⇒ “1.1 Safety precautions when working on the fuel system”, page 1

⇒ “1.2 Safety precautions when using testers and measuring instruments during a road test”, page 2

1.1 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:

WARNING

Risk of injury - fuel system operates under high pressure.

- *Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*
- *Vehicles with FSI engine: fuel system components on the engine that are fed from the high-pressure pump operate under very high pressure. When working on the engine or injection system, the pressure in the high-pressure section of the system must be reduced to a residual pressure prior to opening ⇒ Rep. gr. 24 .*

Health risk: avoid skin contact with fuel.

- *Avoid skin contact with fuel. Wear fuel-resistant gloves.*

Mobile phones can cause an explosion risk.

- *Ensure that any mobile phones are well clear of the workbay.*

Perform the following steps before starting work on the fuel system:

- Fuel tank must not be full. The amount of fuel which can be left in the fuel tank is indicated in the corresponding procedure description. Drain fuel tank if necessary: rest-of-world vehicles ⇒ page 7 , USA vehicles ⇒ page 112 .
- Before commencing work, switch on exhaust extraction system and place an extraction hose close to the opening in the fuel tank to extract escaping petrol fumes.
- If no exhaust extraction system is available, a radial fan with a displacement of at least 15 m^3/h can be used (the fan motor must be clear of the air stream).

Fuel tank must be empty when installing and removing to reduce weight. Drain fuel tank if necessary: rest-of-world vehicles ⇒ page 7 , USA vehicles ⇒ page 112 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.

- ◆ Do not touch or disconnect ignition coils with output stages when the engine is running or being turned at cranking speed.
- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ Always switch off ignition before washing engine.
- ◆ When installing, note colour coding of plug-in connectors.
- ◆ Plug-in connectors should engage audibly when connecting.
- ◆ Pull plug-in connectors to check that they are correctly engaged.
- ◆ Erase any entries in event memory resulting from testing or installation ⇒ Vehicle diagnostic tester, `Guided Functions`, `Interrogate event memory`, then `Generate readiness code`.

> **Caution**
>
> *To prevent irreparable damage to the electronic components when disconnecting the battery:*
>
> - ◆ *Observe notes on procedure for disconnecting the battery.*
> - ◆ *Always switch off the ignition before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 .*

1.2 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:

> **WARNING**
>
> *Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.*
>
> *Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.*
>
> - *The use of test equipment while driving causes distraction.*
> - *There is an increased risk of injury if test equipment is not secured.*
> - ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

2 Repair instructions

⇒ “2.1 Rules for cleanliness”, page 3

⇒ “2.2 Test conditions”, page 3

⇒ “2.3 Contact corrosion”, page 3

⇒ “2.4 Routing and attachment of pipes, hoses and wiring”, page 4

2.1 Rules for cleanliness

Even small amounts of dirt can cause malfunctions. When working on the fuel supply system and injection system, pay careful attention to the following basic rules:

- Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- Place parts that have been removed on a clean surface and cover them over. Use only lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open, do not work with compressed air and do not move the vehicle.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

2.2 Test conditions

- Battery voltage at least 12.5 V.
- Fuel pump fuse OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump relay - J17- / electric fuel pump 2 relay - J49- OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Fuel pump control unit - J538- OK; checking in `Guided Fault Finding` ⇒ Vehicle diagnostic tester.
- Fuel tank at least $^{1}/_{4}$ full.
- Fuel filter OK.
- Fuel lines OK (not obstructed or crushed).
- Ignition off.

2.3 Contact corrosion

Contact corrosion can occur if unsuitable fasteners are used (e.g. bolts, nuts, washers, etc.).

For this reason, only fasteners with a special surface coating are used.

Additionally, all rubber and plastic parts and all adhesives are made of non-conductive materials.

Always install new parts if you are not sure whether used parts can be re-fitted ⇒ Electronic parts catalogue .

Note the following:

- We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- We recommend the use of Audi accessories.
- Damage caused by contact corrosion is not covered under warranty.

2.4 Routing and attachment of pipes, hoses and wiring

> Caution
>
> *Risk of damage to pipes/hoses/wiring.*
>
> - *The original routing must be restored when installing any kind of pipes/hoses/wiring.*
> - *Due to the restricted space in the engine compartment, it is important to ensure sufficient clearance from all moving or hot components.*

20 – Fuel supply system

1 Fuel tank with attached components - all rest-of-world vehicles

⇒ “1.1 Fuel tank with attached components - exploded view”, page 5

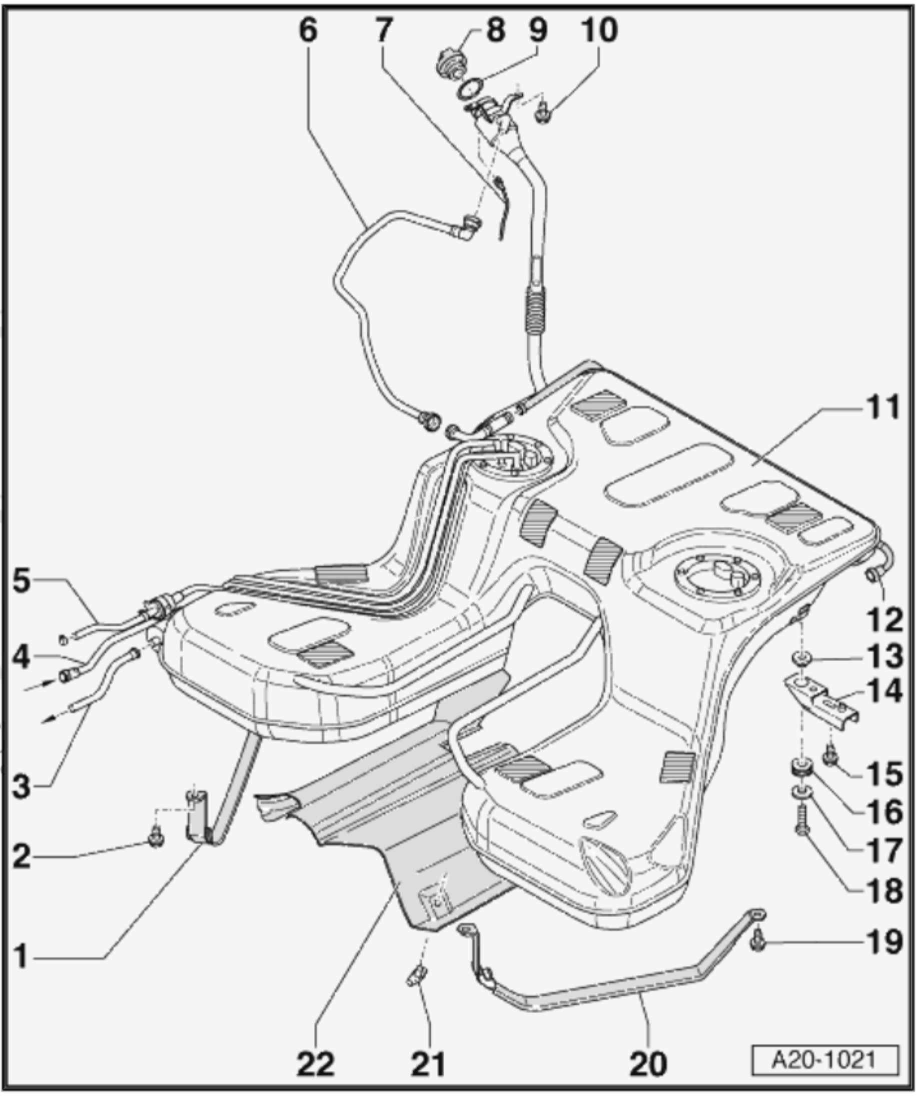
⇒ “1.2 Draining fuel tank”, page 7

⇒ “1.3 Removing and installing fuel tank with attached components”, page 10

1.1 Fuel tank with attached components - exploded view

Note

The illustration shows a fuel system with fuel return line.



1 - Securing strap
- ❑ With spacer, installation position ⇒ page 6

2 - Bolt
- ❑ 22 Nm

3 - Fuel supply line
- ❑ From fuel filter
- ❑ To engine
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect

4 - Fuel return line
- ❑ From engine
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Note direction of arrow on flange
- ❑ Clip onto fuel tank

5 - Supply line
- ❑ To auxiliary heater

6 - Breather line

7 - Earth connection
- ❑ To eliminate electrostatic charge
- ❑ Installation position / test procedure ⇒ page 7
- ❑ Make sure that connector is securely fitted
- ❑ After installation, use an ohmmeter to check the electrical connection between the fuel filler neck and a bare metal part on the body. Specification: approx. 0 Ω

8 - Filler cap

9 - Seal

- ☐ Renew if damaged

10 - Bolt

- ☐ 22 Nm

11 - Fuel tank

- ☐ Removing and installing ⇒ page 10

12 - Breather line

- ☐ To activated charcoal filter in rear left wheel housing
- ☐ Clip onto fuel tank
- ☐ Remains on fuel tank when tank is removed

13 - Bush

14 - Fuel tank bracket

15 - Bolt

- ☐ 22 Nm

16 - Rubber buffer

17 - Washer

18 - Bolt

- ☐ 22 Nm

19 - Bolt

- ☐ 22 Nm

20 - Securing strap

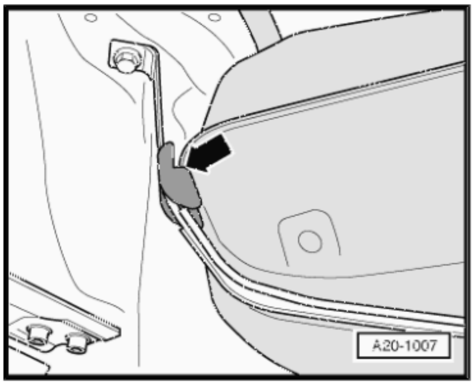
- ☐ With spacer, installation position ⇒ page 6

21 - Retaining clip for heat shield

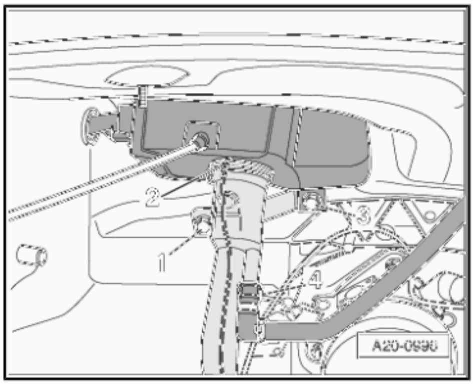
22 - Heat shield

Installation position of spacers

– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



Installation position of earth connection



– Position the earth connection as illustrated -2-.

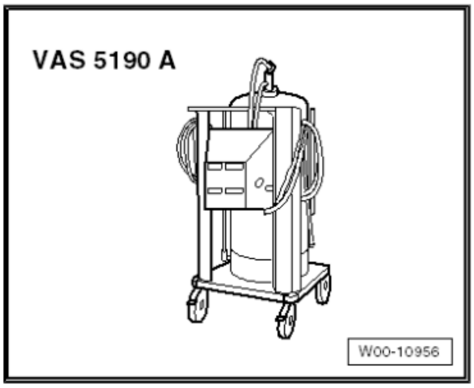
– Ensure that plug connector for earth connection is properly seated on metal ring on fuel filler neck.

> Caution
>
> *After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:*
>
> - *Specification: approx. 0 Ω.*

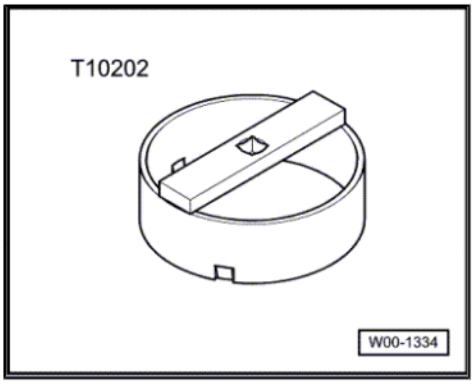
1.2 Draining fuel tank

Special tools and workshop equipment required

- Fuel extractor - VAS 5190A-



- Vehicles from approx. 11.2002: Wrench - T10202-



Procedure

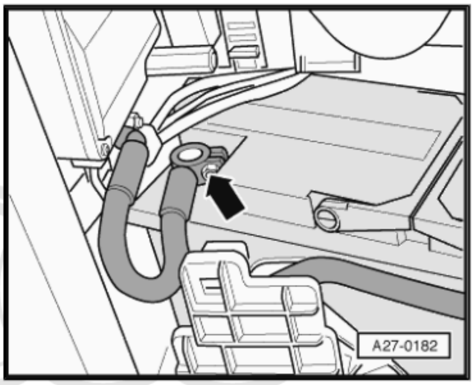
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

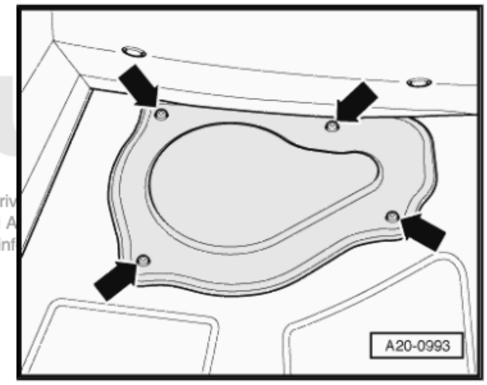
– Briefly open filler cap for fuel tank and close again.

> Caution
>
> *Observe notes on procedure for disconnecting the battery.*

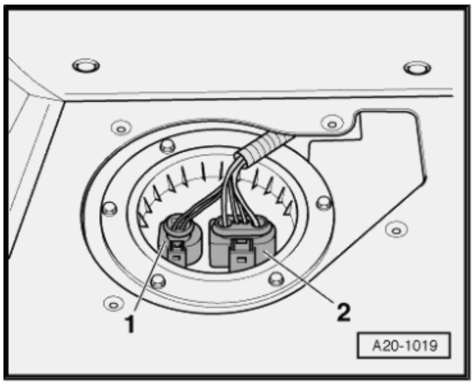
- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.

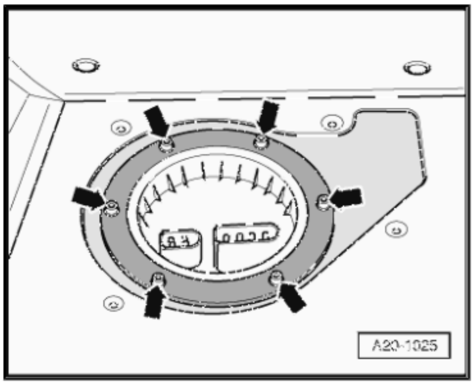


- Unplug electrical connectors -1- and -2- on flange (left-side).



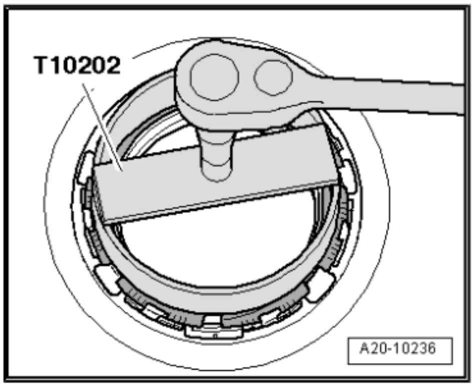
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (left-side).



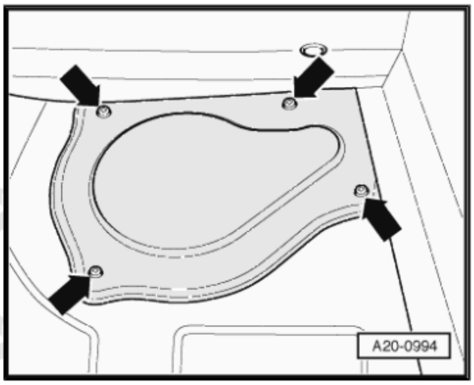
Vehicles from approx. 11.2002 onwards:

- Unscrew locking ring using wrench - T10202- .

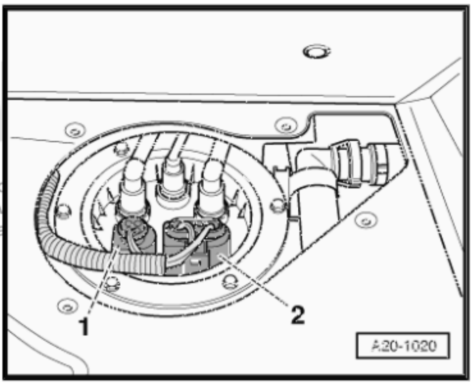


All vehicles (continued):

- Unscrew cover for flange (right-side) -arrows-.

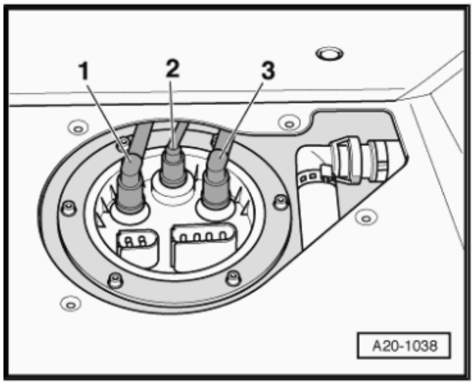


- Unplug electrical connectors -1- and -2- on flange (right-side).



- Mark fuel return line -1- and fuel supply line -3-.

> **WARNING**
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*



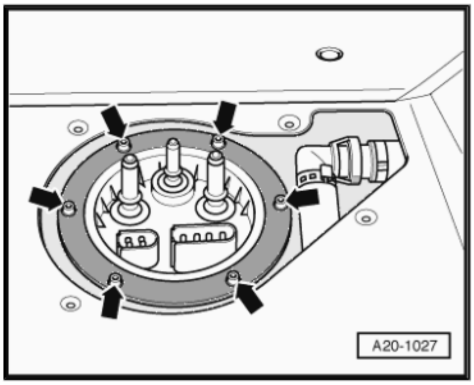
- Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

- In addition, disconnect fuel supply line -2- for auxiliary heater.

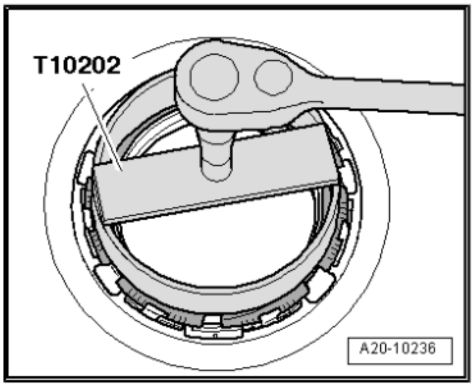
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

– Unscrew locking ring using wrench - T10202- .



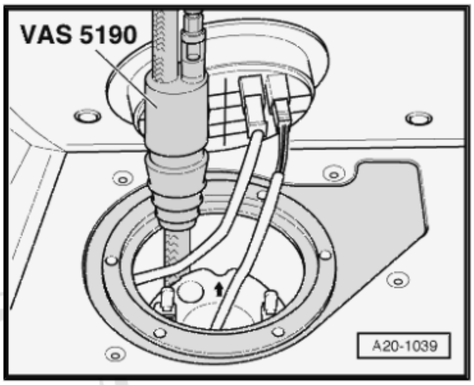
All vehicles (continued):

– Connect earth wire of fuel extractor - VAS 5190A- to earth stud of energy management control unit - J644- .

– Remove flange (left-side) and lay it aside with electrical wires connected.

– Remove seal/O-ring.

– Extract fuel from left fuel tank chamber through fuel tank opening using fuel extractor - VAS 5190A- .

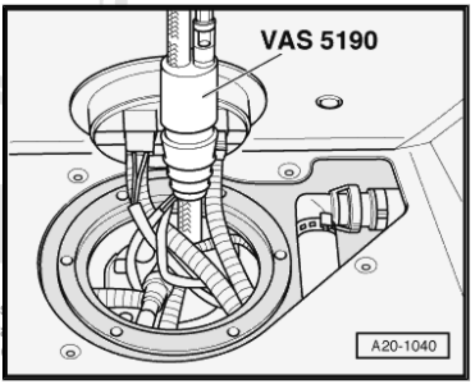


– Remove flange (right-side) and lay it aside with electrical wires and fuel lines connected.

– Remove seal/O-ring.

– Extract fuel from right fuel tank chamber through fuel tank opening using fuel extractor unit - VAS 5190A- .

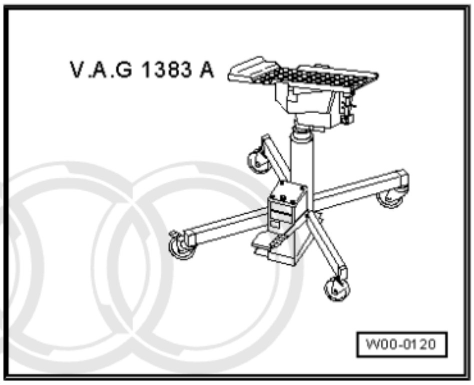
– Re-install flange: left-side ⇒ page 31 , right-side ⇒ page 48 .



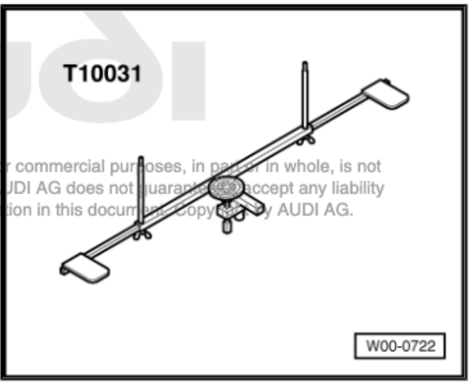
1.3 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

- ◆ Engine and gearbox jack - V.A.G 1383 A-



- ◆ Support - T10031-



Removing

Observe safety precautions ⇒ page 1 .

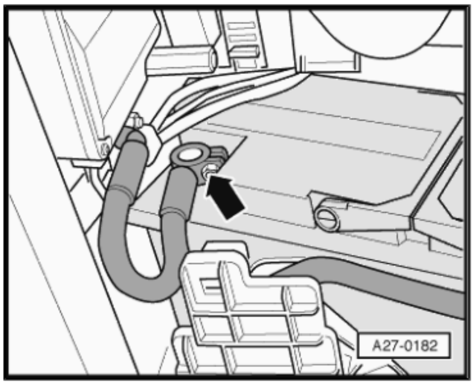
Observe rules for cleanliness ⇒ page 3 .

- To reduce weight, the fuel tank must be empty when it is removed from the vehicle. Drain the tank if necessary. Procedure ⇒ page 7

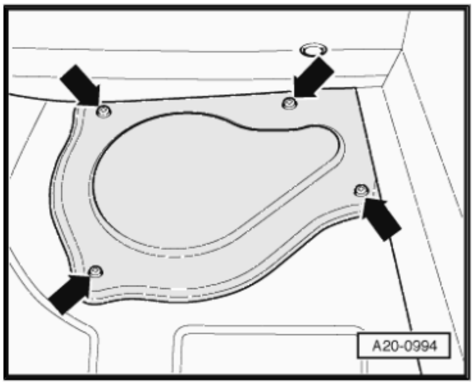
– Release the tank flap.

> Caution
>
> *Observe notes on procedure for disconnecting the battery.*

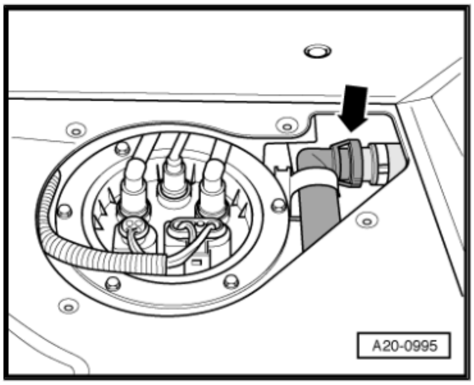
– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



- Remove luggage compartment floor covering.
- Unscrew cover for flange (right-side) -arrows-.



- Press release tabs to disconnect breather pipe -arrow-.

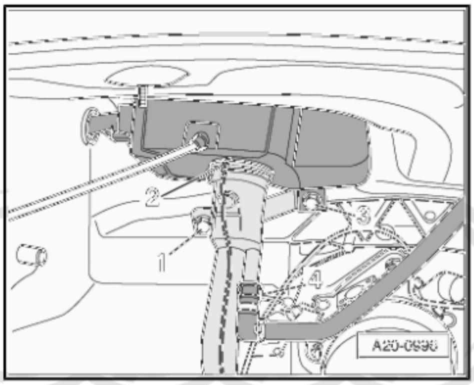


WARNING

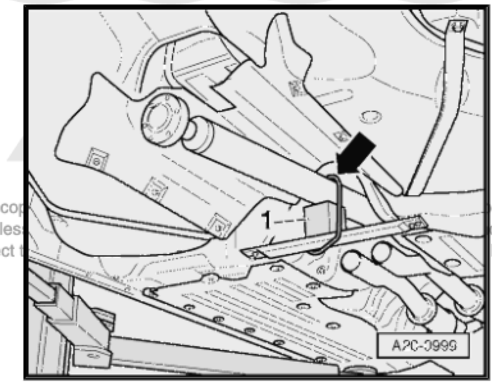
BEFORE loosening the subframe bolts, ensure that the vehicle cannot tip forwards (for instance by putting a weight of about 50 kg in the luggage compartment).

- Remove rear axle ⇒ Rep. gr. 42 .
- Remove rear right wheel housing liner ⇒ Rep. gr. 66 .

- Disconnect earth wire -2- from fuel filler neck.
- Disconnect breather pipe -4- from fuel filler neck.
- Remove bolts -1- and -3- for fuel filler neck.



- Check that propshaft is secured to prevent it falling.
- The propshaft should be placed on a block of wood -1- and secured with wire or a cable tie -arrow-.
- The propshaft should be inclined slightly downwards to ensure there is sufficient space when installing the fuel tank.



Note

The propshaft must not be bent more than 8°.

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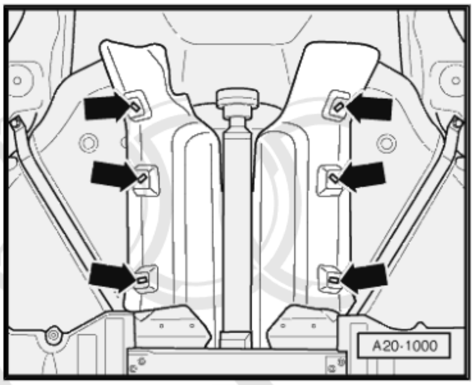
– Remove heat shield for propshaft -arrows-.



– Remove cover -1- from underside of vehicle (left-side).

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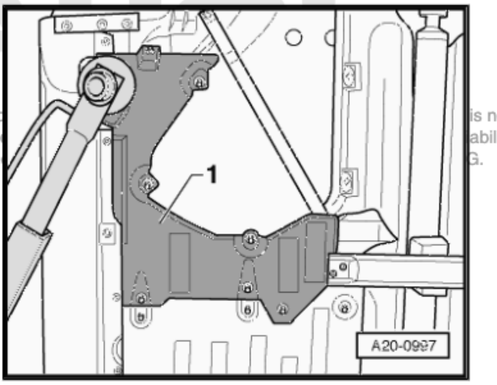
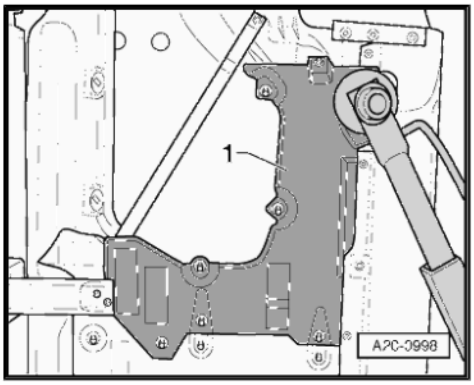


– Remove cover -1- from underside of vehicle (right-side).



– Unplug electrical connectors:

1 - To metering pump for auxiliary/additional heater

3 - To fuel pumps

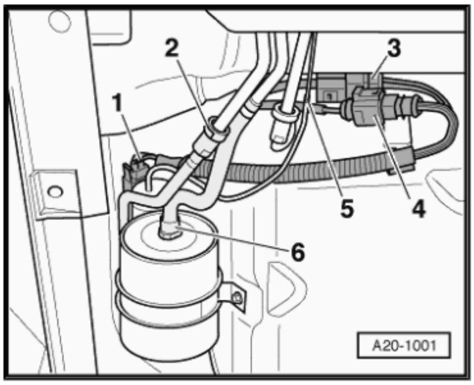
4 - To fuel gauge senders

– Disconnect fuel pipes (press release tabs):

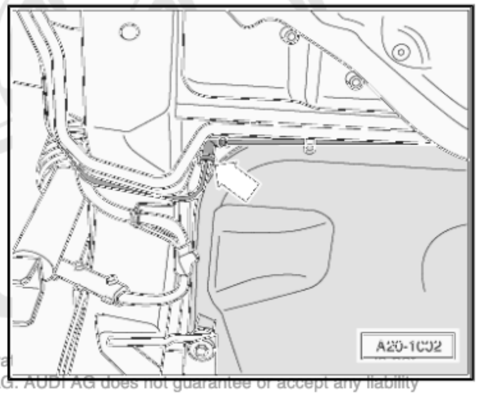
2 - Fuel return line (only MPI engines with return line)

5 - Fuel pipe to metering pump for auxiliary/additional heater

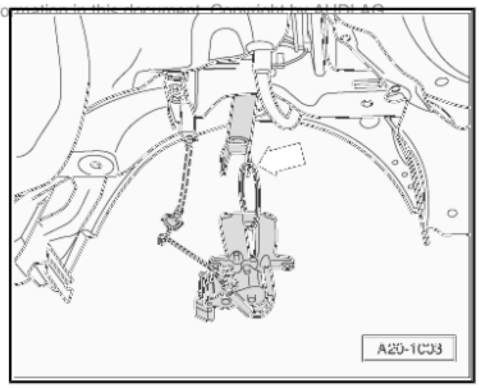
6 - Fuel supply line



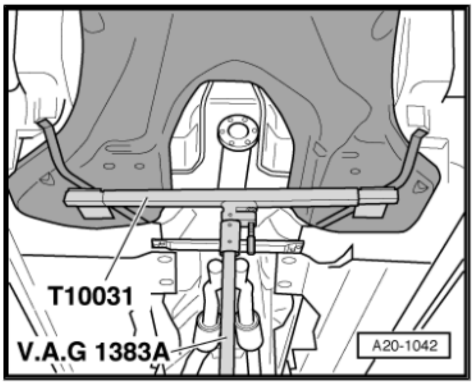
- Disconnect breather pipe -arrow- at rear left of fuel tank (press release tab).



- Attach brake calipers to suspension struts with wire -arrow- (brake calipers were fastened to fuel tank brackets upon removal of rear suspension).



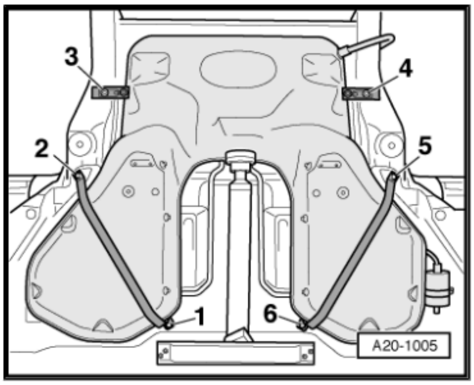
- Position engine and gearbox jack - V.A.G 1383 A- with support - T10031- under vehicle to support tank (do not use threaded rods of support).
- Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
- In addition, a 2nd mechanic will be required to support the fuel tank at the rear by hand.



WARNING

To reduce weight, fuel tank must be empty upon removal.

- Unscrew bolts -1 ... 6-; swivel fuel tank brackets forward if necessary.
- First lower fuel tank slightly at the rear so the fuel filler neck can be guided out of the body.
- Then lower fuel tank using engine and gearbox jack - V.A.G 1383 A- .



Note

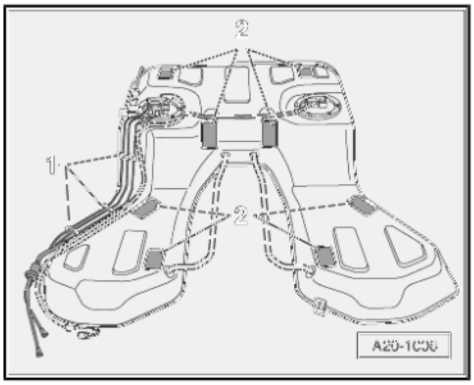
For illustration purposes the fuel tank is shown without engine and gearbox jack.

Installing

- Tightening torques ⇒ page 5

– Check that fuel pipes and wiring harness for fuel pumps and fuel gauge senders are clipped into brackets -1- on fuel tank.

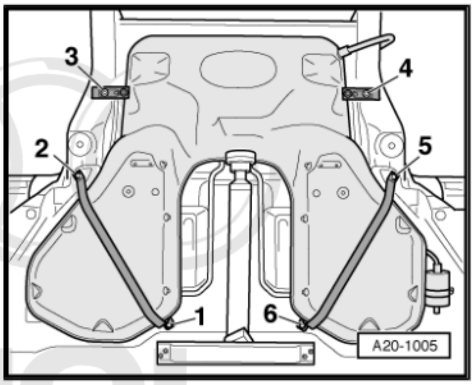
– Bond pads -2- to fuel tank as shown when installing new fuel tank.



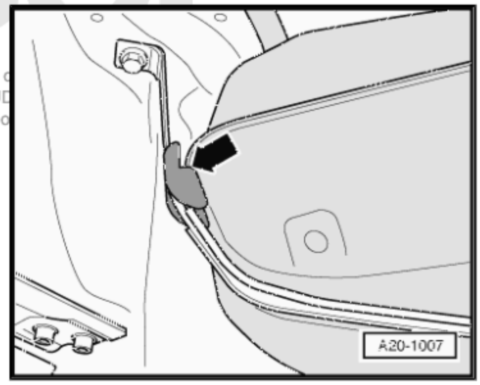
– Position fuel tank with securing straps and brackets on underbody, using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .

– When installing fuel tank, make sure that the fuel filler neck is correctly inserted into the opening on the body.

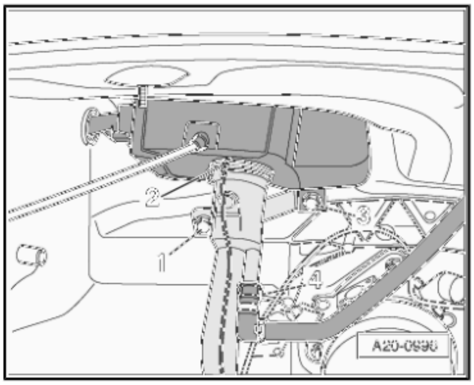
– Secure fuel tank by first tightening bolts at points -1-, -2-, -5- and -6-, then at points -3- and -4-.



– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



- Secure fuel filler neck using bolts -1- and -3-.
- Fit breather pipe -4- so that it engages audibly.
- Check the earth wiring -2- and connector tab for traces of oxidation. Remove any traces of oxidation if necessary.



Caution

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

Remaining installation steps are carried out in reverse sequence; note the following:

Note

◆ *Always renew seals and gaskets when assembling.*

◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Install rear axle ⇒ Rep. gr. 42 .
- Install rear right wheel housing liner ⇒ Rep. gr. 66 .
- Install rear section of exhaust system ⇒ Rep. gr. 26 .
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

Vehicles with auxiliary heater:

- Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.

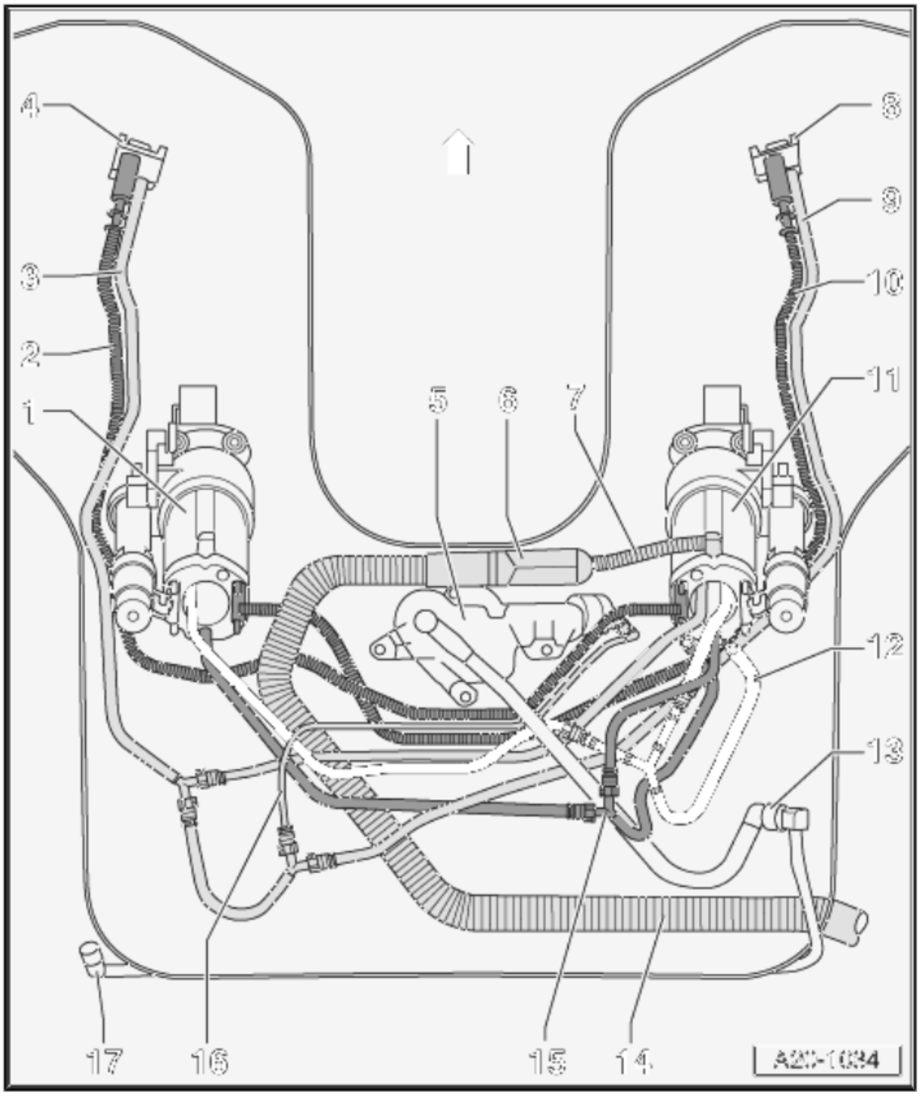
2 Routing of pipes/hoses (inside fuel tank) - rest-of-world vehicles with MPI engine

⇒ “2.1 Routing of pipes/hoses (inside fuel tank) - exploded view”, page 17

2.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 18 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line

- ❑ From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump

- ❑ From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Expansion tank

- ❑ With suction-jet pump to extract fuel from expansion tank

6 - Non-return flap

- ❑ For fuel filler pipe

7 - Primary filler pipe

- ❑ To fuel delivery unit (right-side).
- ❑ Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

8 - Suction-jet pump (right-side)

9 - Supply line for suction-jet pump

- ❑ From fuel pump (right-side) to suction-jet pump (right-side)

10 - Fuel supply line

- ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

11 - Fuel delivery unit (right-side) with fuel pump - G23-

12 - Fuel supply line

- ❑ From fuel pumps (left and right) to flange

13 - Breather line

- ❑ From expansion tank to breather connection on outside of fuel tank

14 - Fuel filler pipe

- ❑ From fuel filler neck to non-return flap in fuel tank

15 - Fuel return line

- ❑ From flange to fuel delivery units (left and right)

16 - Supply line for suction-jet pump

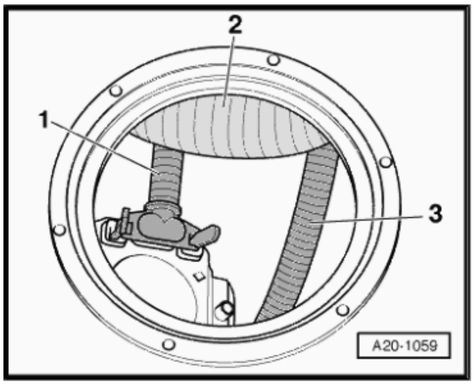
- ❑ To suction-jet pump in expansion tank

17 - Breather line

- ❑ To activated charcoal filter in rear left wheel housing

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



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3 Fuel delivery unit with fuel pump and fuel gauge senders - rest-of-world vehicles with MPI engine

⇒ “3.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 19

⇒ “3.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 21

⇒ “3.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 26

⇒ “3.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 36

⇒ “3.5 Checking fuel pump G23 (right-side) - electrical test”, page 39

⇒ “3.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 42

⇒ “3.7 Checking delivery rate of fuel pumps - vehicles with fuel return line”, page 53

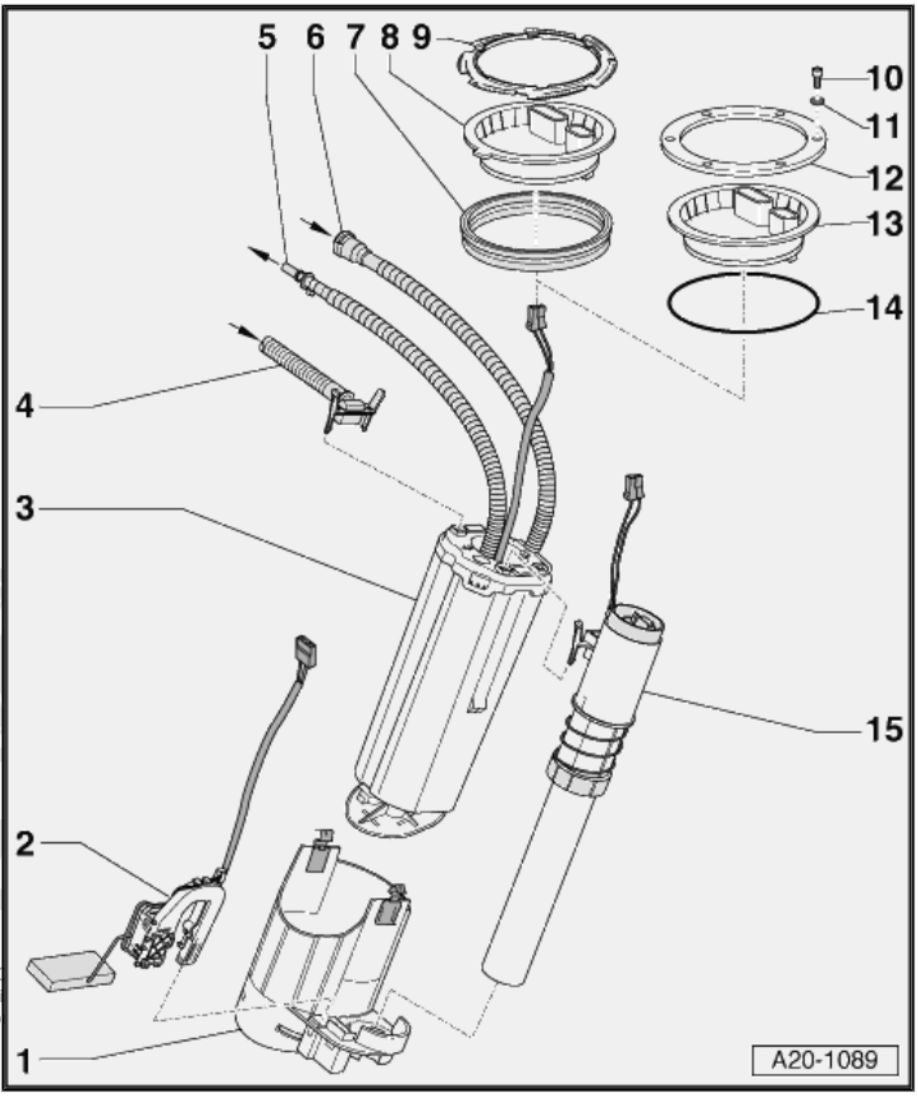
⇒ “3.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line”, page 56

⇒ “3.9 Suction-jet pumps”, page 60

⇒ “3.10 Removing and installing suction-jet pump (left-side)”, page 62

⇒ “3.11 Removing and installing suction-jet pump (right-side)”, page 63

3.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-



1 - Retainer
- ☐ For fuel delivery unit

2 - Fuel gauge sender - G-
- ☐ Black
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 201
- ☐ Removing and installing ⇒ page 202

3 - Fuel delivery unit (left-side)
- ☐ With fuel system pressurisation pump - G6-
- ☐ Clipped onto retainer -item 1-
- ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ☐ Checking fuel pump (electrical test) ⇒ page 21
- ☐ Checking residual pressure ⇒ Rep. gr. 24
- ☐ Removing and installing ⇒ page 26
- ☐ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line
- ☐ From suction jet pump (right-side)
- ☐ Clipped onto fuel delivery unit -item 3-

5 - Fuel supply line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

6 - Fuel return line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

7 - Seal
- ☐ Applies to vehicles from approx. 11.2002
- ☐ Renew
- ☐ Install dry

8 - Flange (left-side)
- ☐ Applies to vehicles from approx. 11.2002
- ☐ Installation position ⇒ page 21

9 - Locking ring
- ☐ Applies to vehicles from approx. 11.2002
- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

10 - 10 Nm

- ☐ Applies to vehicles up to approx. 10.2002
- ☐ Tighten bolts in diagonal sequence

11 - Washer

- ☐ Applies to vehicles up to approx. 10.2002

12 - Locking ring

- ☐ Applies to vehicles up to approx. 10.2002
- ☐ For flange

13 - Flange (left-side)

- ☐ Applies to vehicles up to approx. 10.2002
- ☐ Installation position ⇒ page 21

14 - O-ring

- ☐ Applies to vehicles up to approx. 10.2002
- ☐ Renew

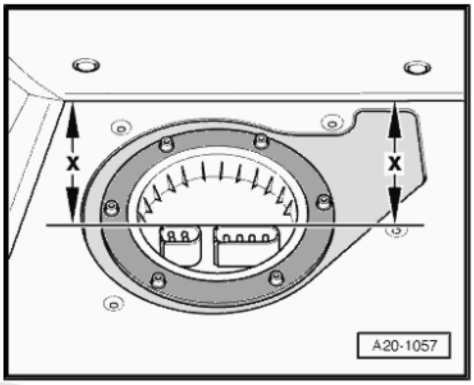
15 - Fuel gauge sender 3 - G237-

- ☐ Grey
- ☐ Clipped onto fuel delivery unit -item 3-
- ☐ Checking resistance values ⇒ page 205
- ☐ Removing and installing ⇒ page 206

Installation position of flange (left-side) - vehicles up to approx. 10.2002

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)

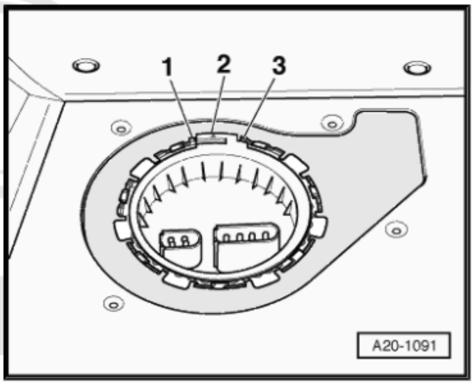


Installation position of flange (left-side) - vehicles from approx. 11.2002

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

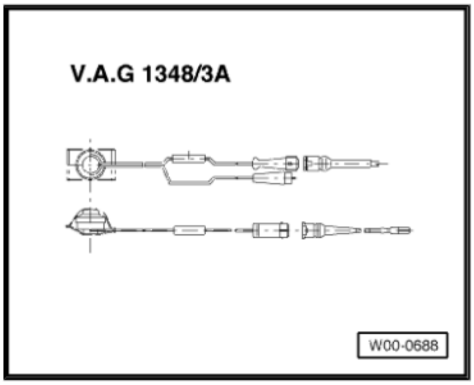
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



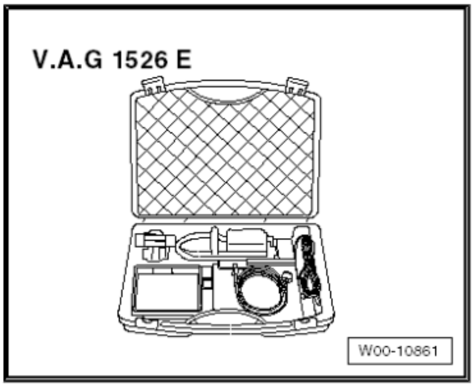
3.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

Special tools and workshop equipment required

- Remote control for V.A.G 1348 - V.A.G 1348/3A-

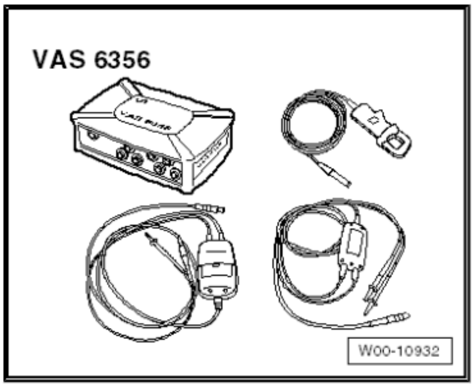


- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-

- Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-

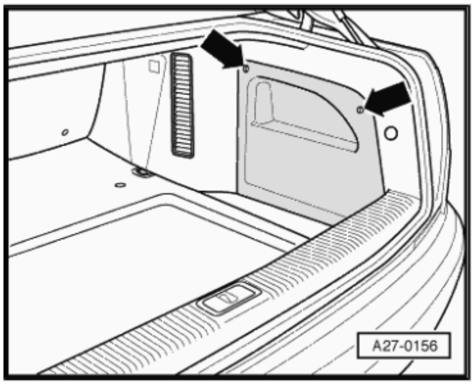


Procedure

– Observe test conditions ⇒ page 3 .

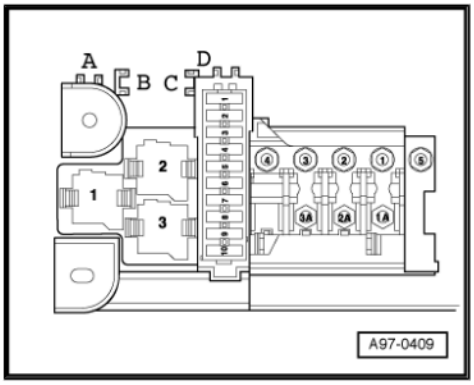
Checking voltage supply

- Remove luggage compartment side trim cover (right-side) -arrows-.



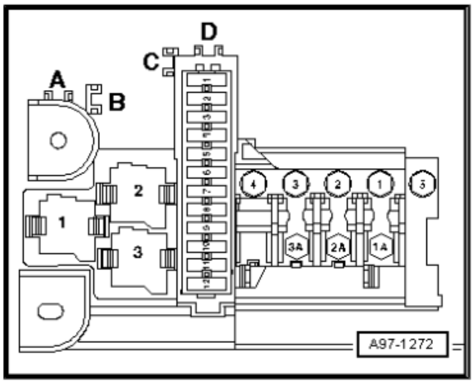
Vehicles built in model year 2003:

- Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



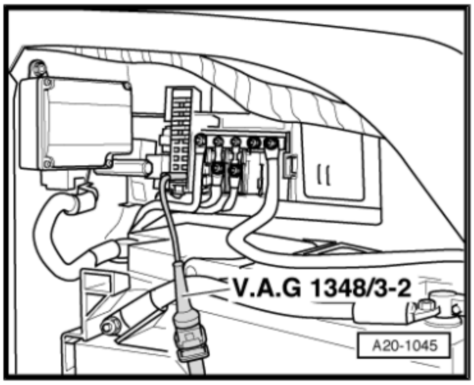
Vehicles from model year 2004 onwards:

- Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).



All vehicles (continued):

- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.
- Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).
- Press remote control button.
- Fuel pump should start running (noise is audible in vicinity of fuel tank).

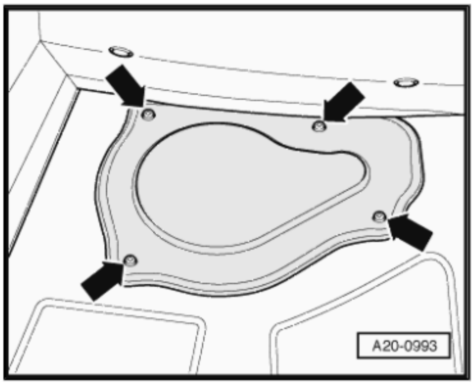


Note

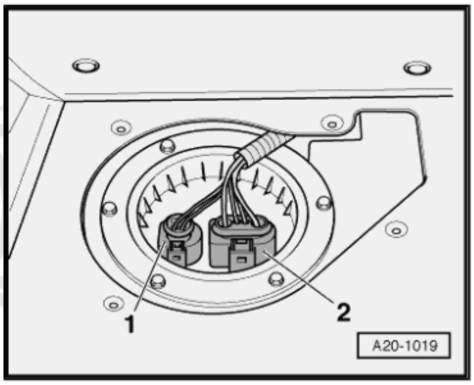
The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

If no noise can be heard from pump:

- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



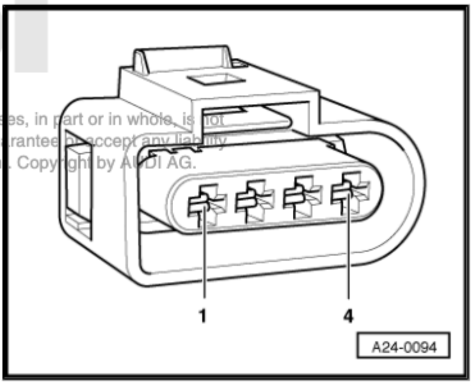
- Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

- Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.
- Press remote control button.



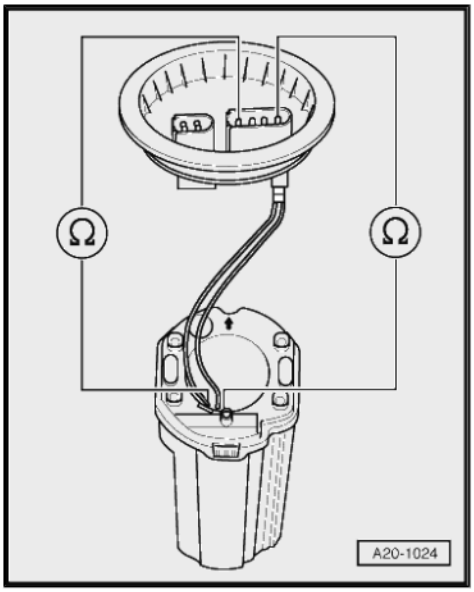
- Specification: approx. battery voltage

If specification is not obtained:

- Repair wiring harness according to current flow diagram.

If reading matches specification although no noise can be heard from pump:

- Remove the fuel delivery unit (left-side) ⇒ page 26 .
- Check that the electrical wires between flange and fuel pump are connected and test for continuity.



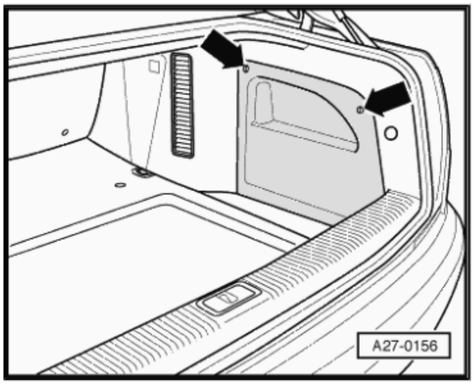
If no faults are found in the wiring:

- Fuel pump is defective. Renew the fuel delivery unit (left-side).
- Install fuel delivery unit (left-side) ⇒ page 31 .

Checking current draw

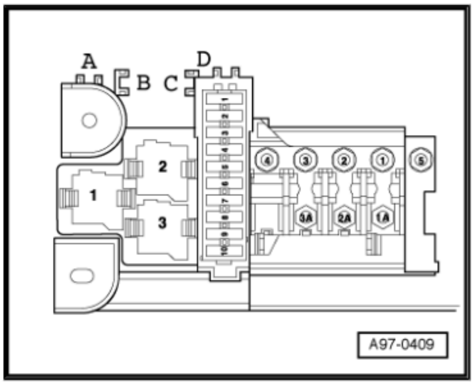
- Fuel pump voltage supply OK ⇒ page 23

– Remove luggage compartment side trim cover (right-side) -arrows-.



Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



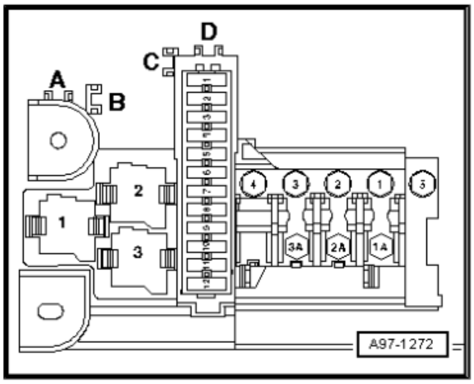
Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).

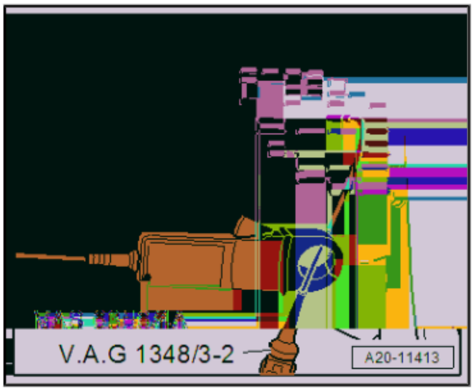
All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



- Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
- Press remote control button.
- Measure current draw of fuel pump.



- Specification: approx. 8 A.

If specification is not obtained:

Note

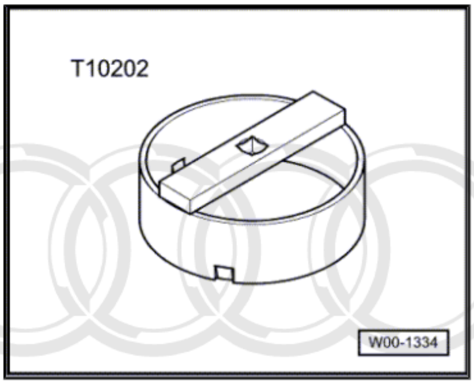
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	◆ Fuel tank empty	– Fill tank
	◆ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 26
0 A	◆ Fuel system pressurisation pump - G6- defective	– Renew fuel delivery unit ⇒ page 26

3.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

◆ Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

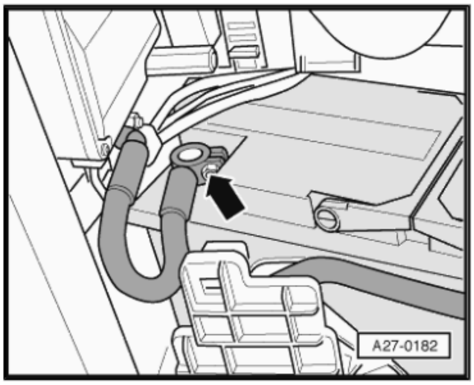
Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must not be more than $^{1}/_{3}$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Caution

Observe notes on procedure for disconnecting the battery.

- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

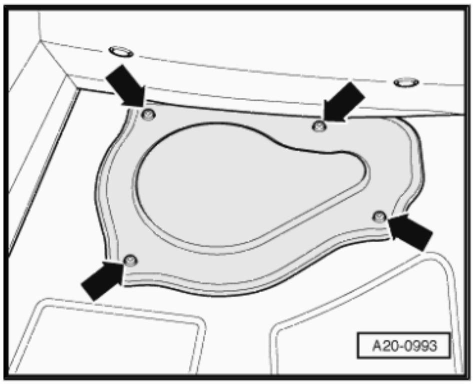


- Remove luggage compartment floor covering.

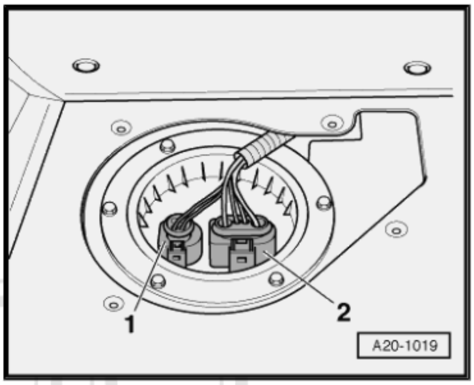
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

- Detach cover for flange (left-side) -arrows-.

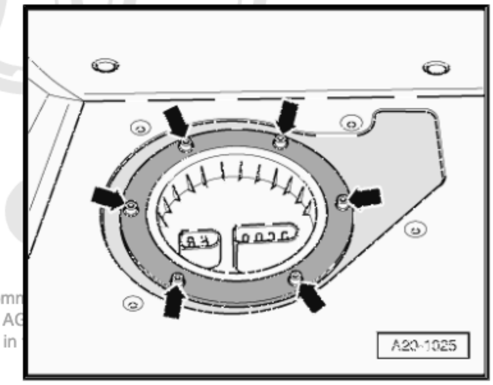


- Unplug electrical connectors -1- and -2- on flange (left-side).



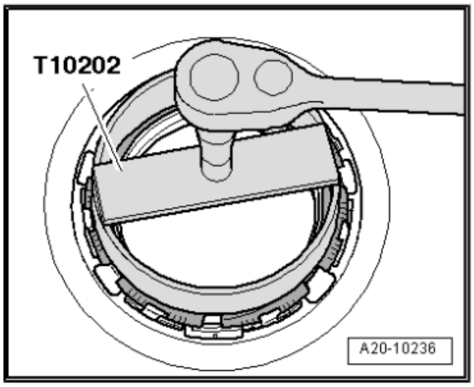
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (left-side).



Vehicles from approx. 11.2002 onwards:

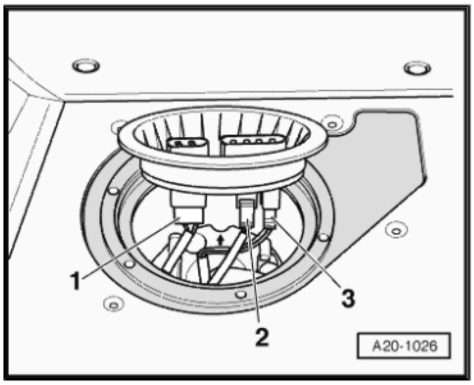
– Unscrew locking ring using wrench - T10202- .



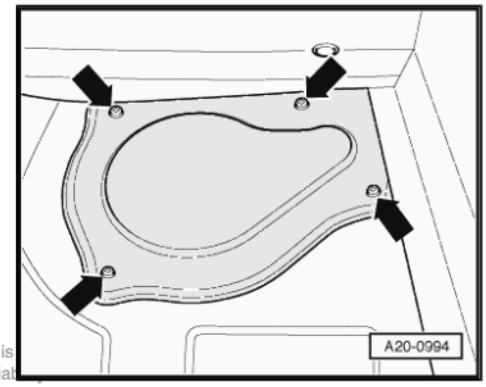
All vehicles (continued):

– Detach flange and remove seal/O-ring.

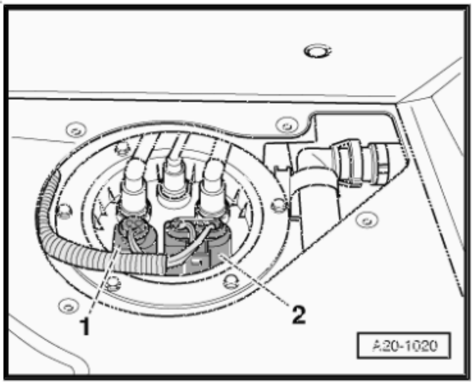
– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



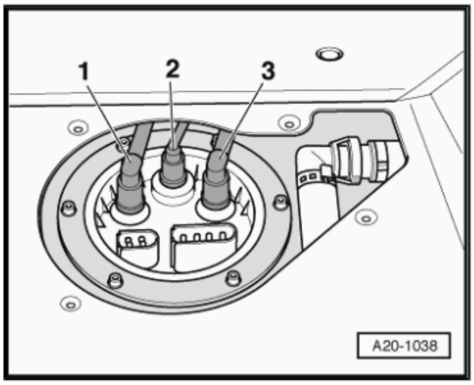
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (right-side).



- Mark fuel return line -1- and fuel supply line -3-.



WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

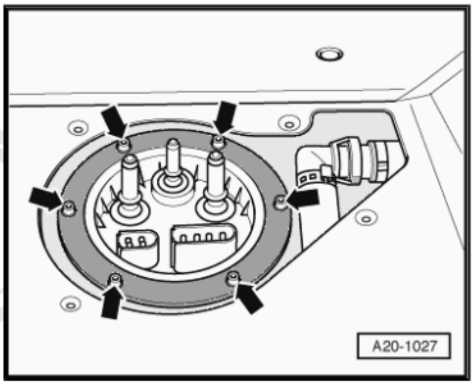
- Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

- In addition, disconnect fuel supply line -2- for auxiliary heater.

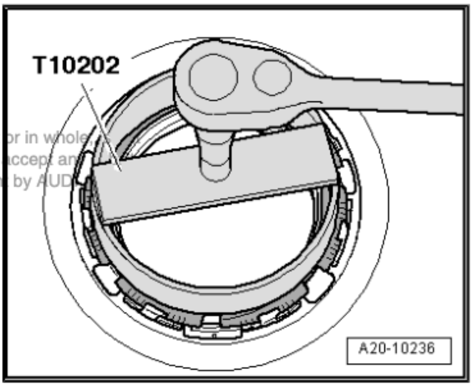
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (right-side).



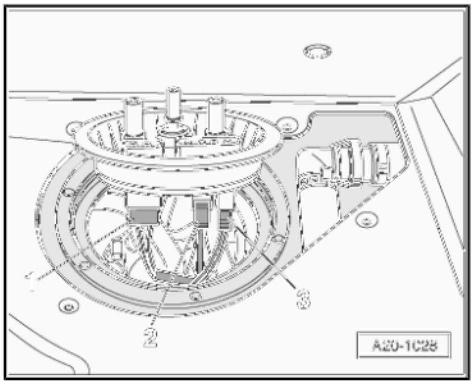
Vehicles from approx. 11.2002 onwards:

- Unscrew locking ring using wrench - T10202- .



All vehicles (continued):

- Detach flange and remove seal/O-ring.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

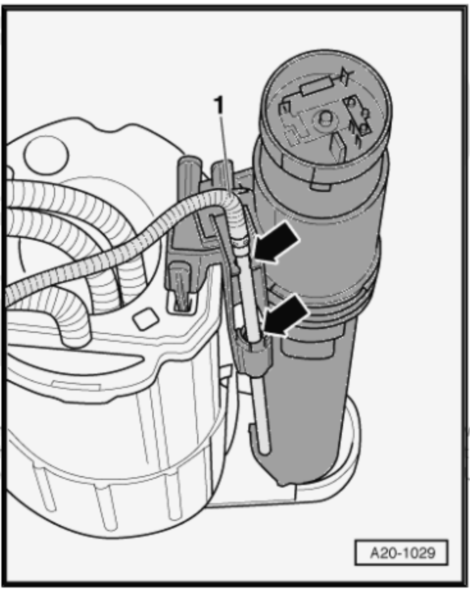


Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.



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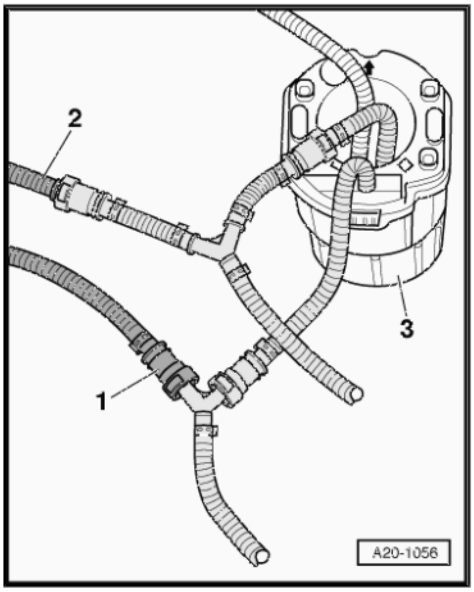
All vehicles (continued):

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

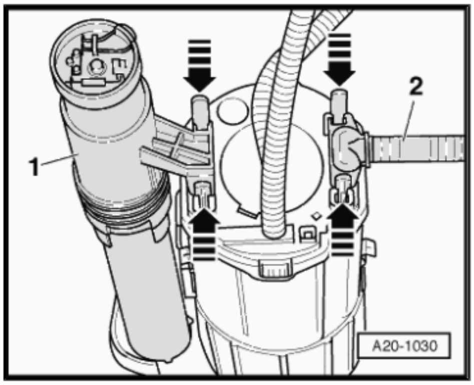
3 - Fuel delivery unit (right-side) with fuel pump - G23-

– Pull the two disconnected fuel lines out of left fuel tank opening.

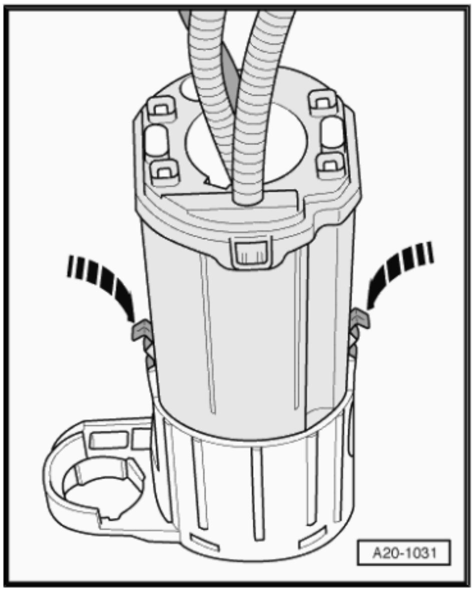


– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

– Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

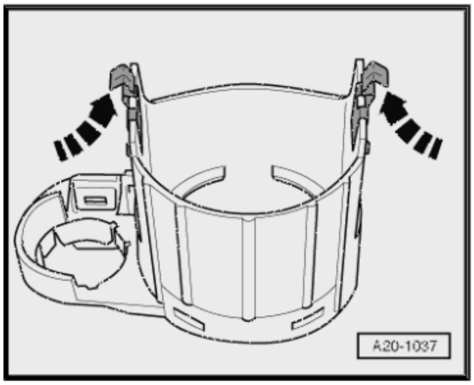


Note

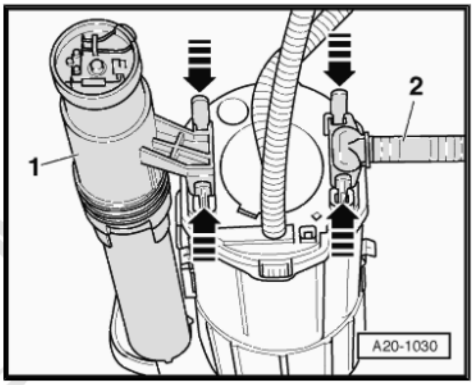
Keep in mind that the fuel delivery unit still contains fuel.

Installing

- Tightening torques ⇒ page 19
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.

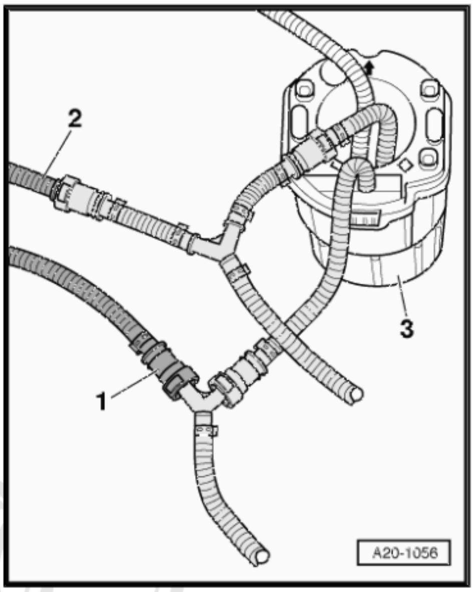


- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
- Guide supply line and return line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



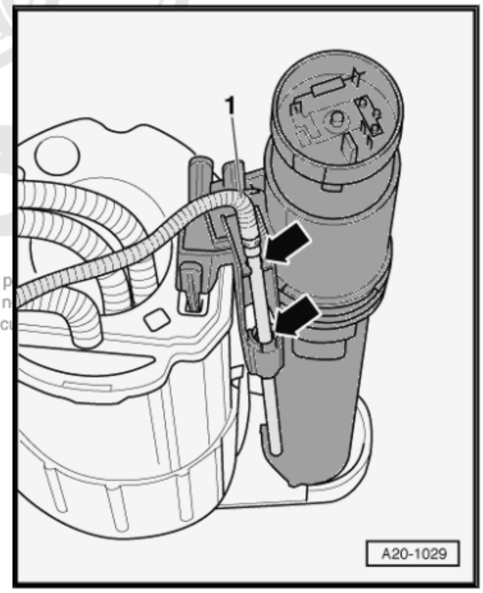
- Fit fuel lines -1- and -2- through right fuel tank opening so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



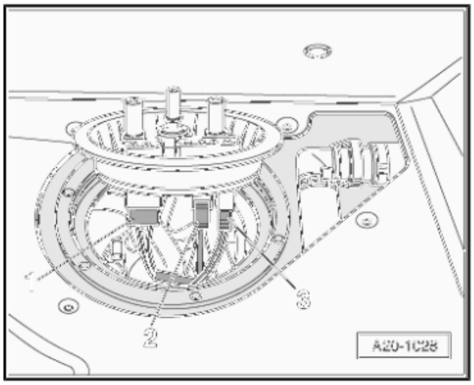
Vehicles with auxiliary heater:

- Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

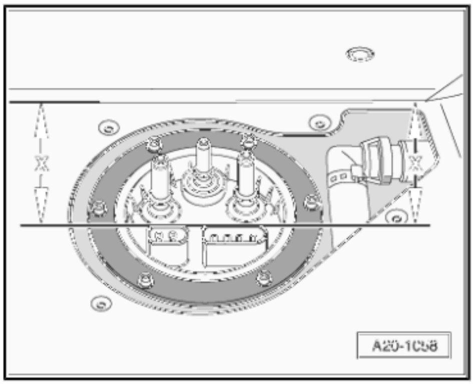
- Connect electrical connectors -1 ... 3- on underside of flange (right-side).



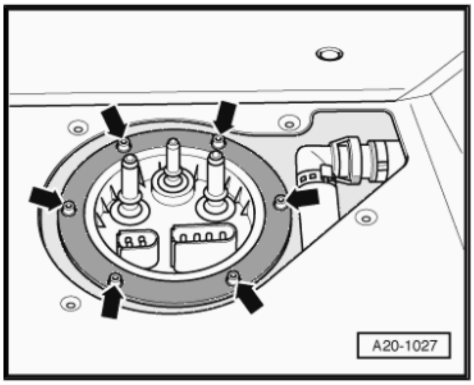
Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.

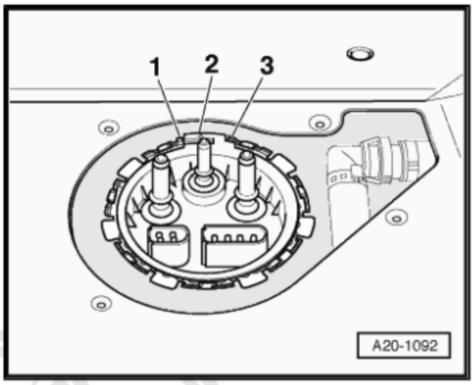


Vehicles from approx. 11.2002 onwards:

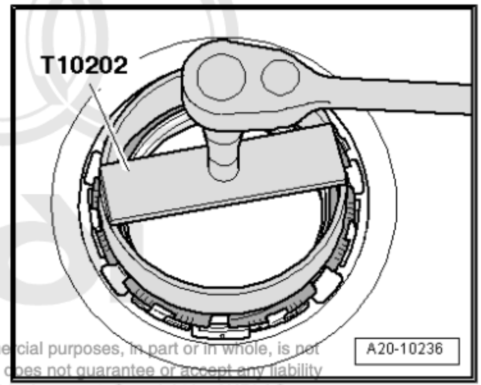
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

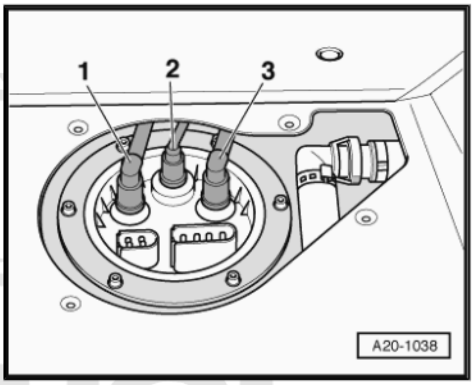


All vehicles (continued):

- Install fuel supply line -3- and fuel return line -1- (as marked) so that they engage audibly.

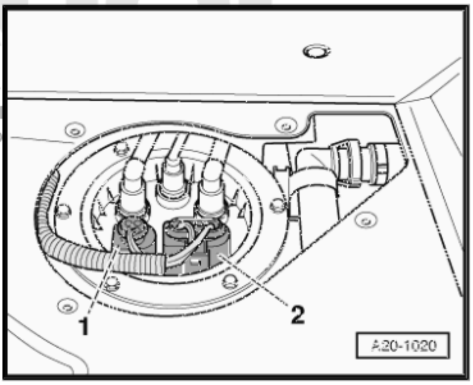
Vehicles with auxiliary heater:

- Also fit supply line -2- going to auxiliary heater so that it engages audibly.

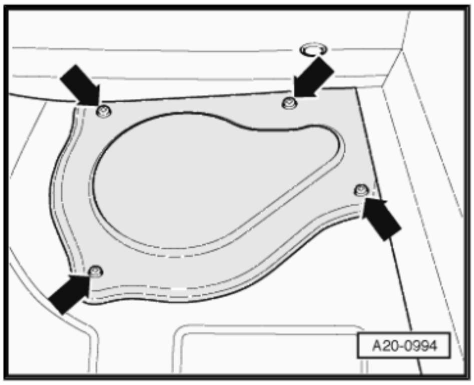


All vehicles (continued):

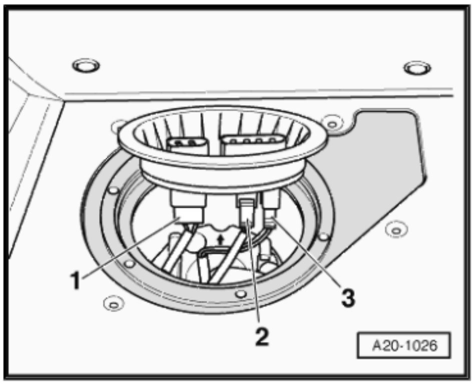
- Attach electrical connectors -1- and -2- on flange (right-side).



- Secure cover for flange (right-side) -arrows-.



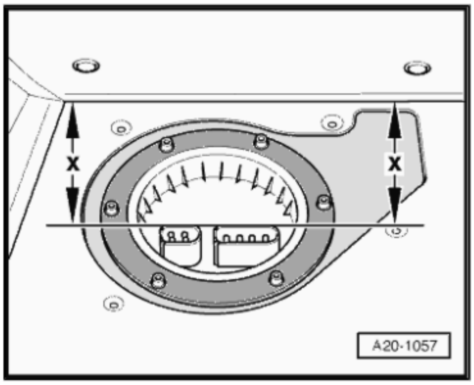
- Connect electrical connectors -1 ... 3- on underside of flange (left-side).



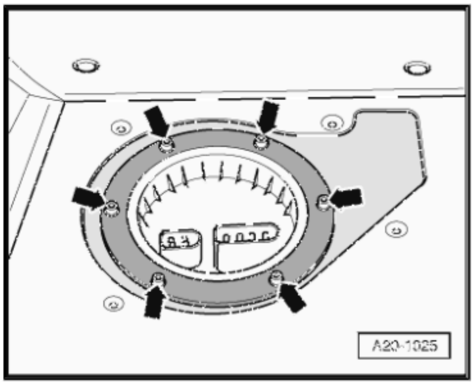
Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

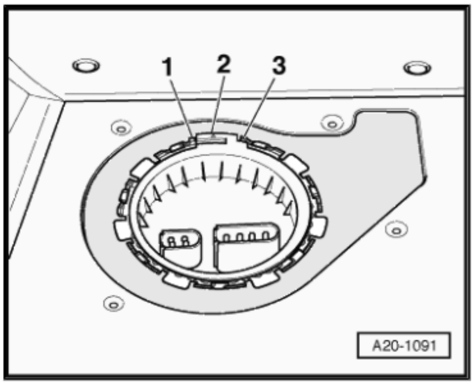


Vehicles from approx. 11.2002 onwards:

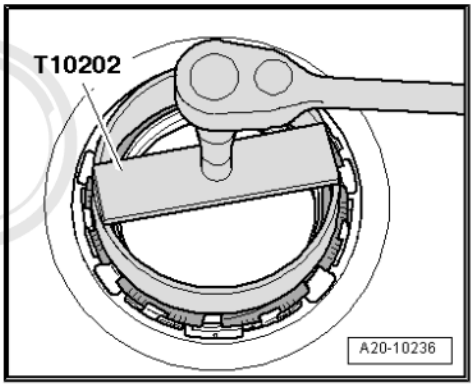
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

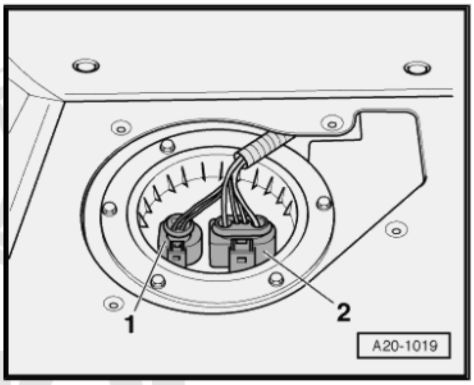


– Tighten locking ring.



All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (left-side).



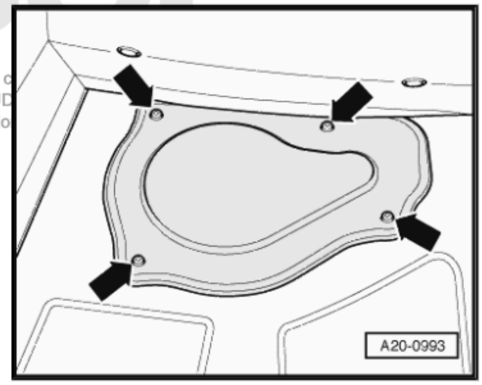
– Secure cover for flange (left-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

– Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



3.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-

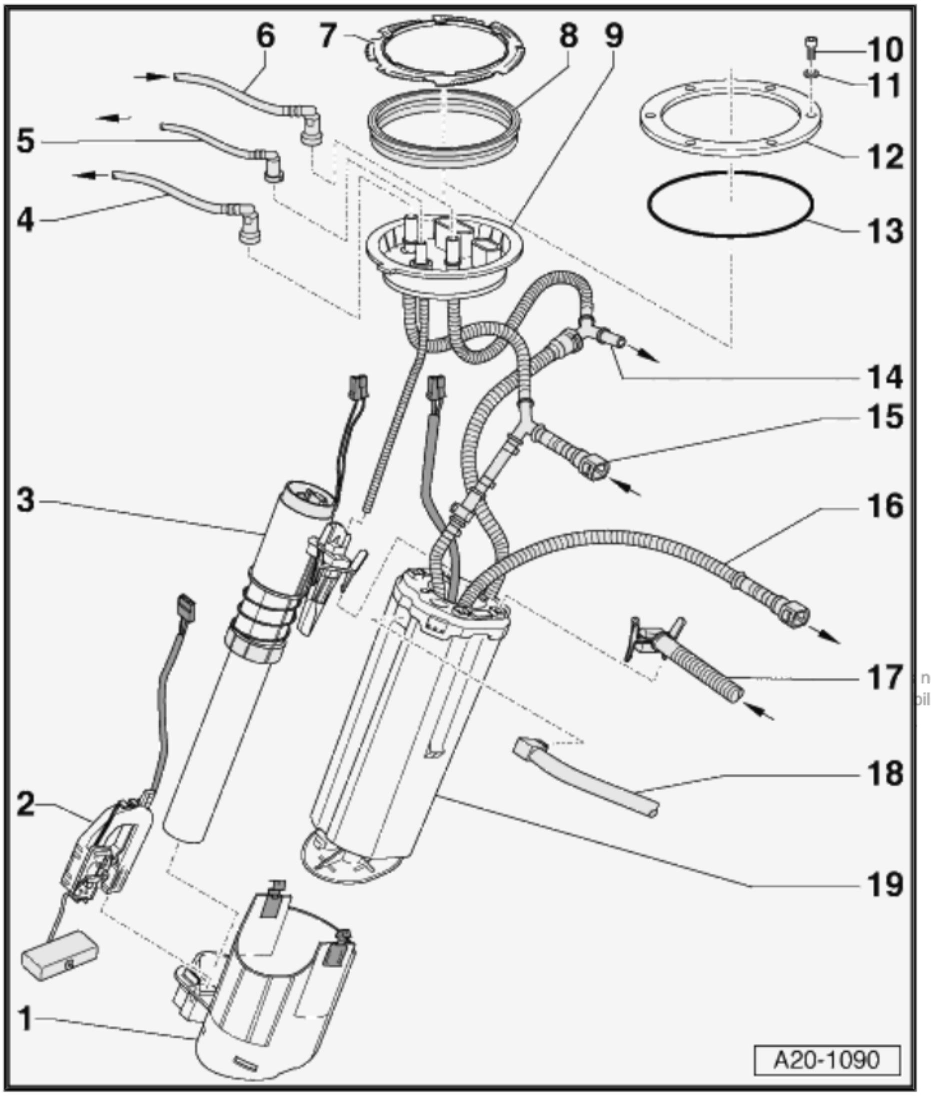
1 - Retainer
- ☐ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-
- ☐ Yellow
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 203
- ☐ Removing and installing ⇒ page 204

3 - Fuel gauge sender 4 - G393-
- ☐ White
- ☐ Clipped onto fuel delivery unit -item 19-
- ☐ Checking resistance values ⇒ page 211
- ☐ Removing and installing ⇒ page 213

4 - Fuel supply line
- ☐ To fuel filter
- ☐ Mark before removing
- ☐ Press release tab on connection piece to disconnect
- ☐ Do not kink
- ☐ Clip onto fuel tank

5 - Fuel supply line
- ☐ To auxiliary heater
- ☐ Press release tab on connection piece to disconnect
- ☐ Do not kink
- ☐ Clip onto fuel tank



not
bility

6 - Fuel return line
- ☐ From engine or fuel filter
- ☐ Mark before removing
- ☐ Press release tab on connection piece to disconnect
- ☐ Do not kink
- ☐ Clip onto fuel tank

7 - Locking ring
- ☐ Applies to vehicles from approx. 11.2002
- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

8 - Seal
- ☐ Applies to vehicles from approx. 11.2002
- ☐ Renew
- ☐ Install dry

9 - Flange (right-side)
- ☐ Installation position up to approx. 10.2002 ⇒ page 38

   ❑ Installation position from approx. 11.2002 ⇒ page 39

10 - 10 Nm

   ❑ Applies to vehicles up to approx. 10.2002
   ❑ Tighten bolts in diagonal sequence

11 - Washer

   ❑ Applies to vehicles up to approx. 10.2002

12 - Locking ring

   ❑ For flange
   ❑ Applies to vehicles up to approx. 10.2002

13 - O-ring

   ❑ Applies to vehicles up to approx. 10.2002
   ❑ Renew

14 - Fuel return line

   ❑ To fuel delivery unit (left-side)

15 - Fuel supply line

   ❑ From fuel delivery unit (left-side)
   ❑ Press release tab on connection piece to disconnect

16 - Supply line for suction-jet pump

   ❑ For suction-jet pump
   ❑ Press release tab on connection piece to disconnect

17 - Fuel supply line

   ❑ From suction-jet pump (left-side)
   ❑ Clipped onto fuel delivery unit -item 19-

18 - Fuel filler pipe

   ❑ From filler neck
   ❑ Clipped onto fuel delivery unit -item 19-

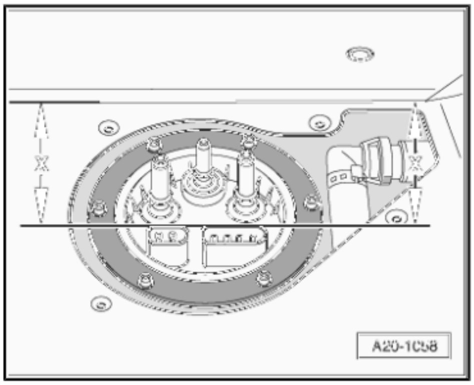
19 - Fuel delivery unit (right-side)

   ❑ With fuel pump - G23-
   ❑ Clipped onto retainer -item 1-
   ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
   ❑ Checking fuel pump (electrical test) ⇒ page 39
   ❑ Checking residual pressure ⇒ Rep. gr. 24
   ❑ Removing and installing ⇒ page 42
   ❑ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side) - vehicles up to approx. 10.2002

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)

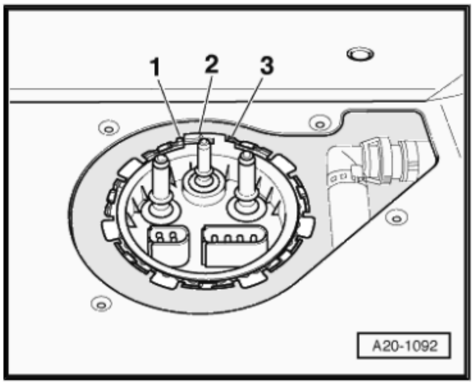


Installation position of flange (right-side) - vehicles from approx. 11.2002

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

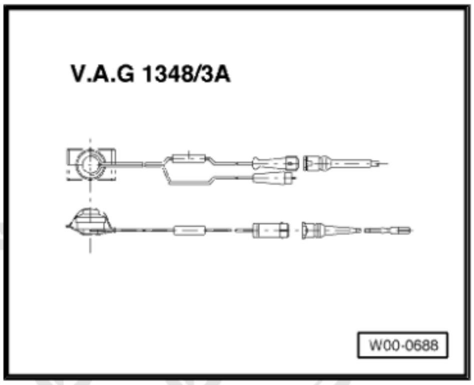
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



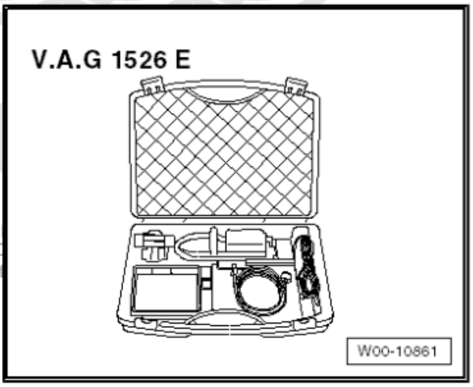
3.5 Checking fuel pump - G23- (right-side) - electrical test

Special tools and workshop equipment required

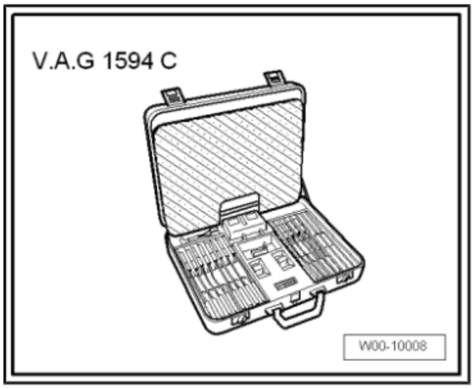
◆ Remote control for V.A.G 1348 - V.A.G 1348/3A-



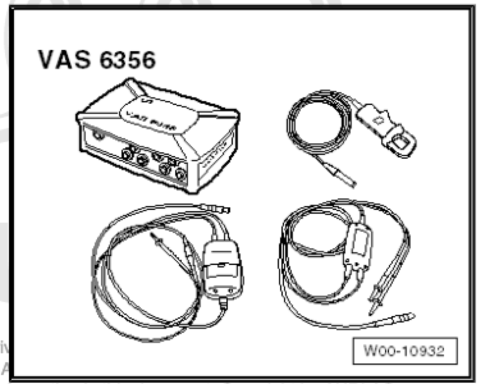
◆ Hand-held multimeter - V.A.G 1526 E-



◆ Auxiliary measuring set - V.A.G 1594C-



- Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-

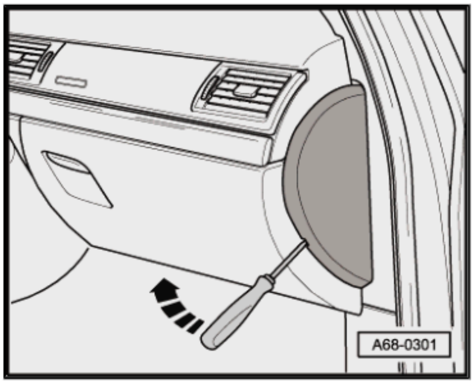


Procedure

– Observe test conditions ⇒ page 3 .

Checking voltage supply

– Use screwdriver to pry off cover (right-side) at dash panel -arrow-.



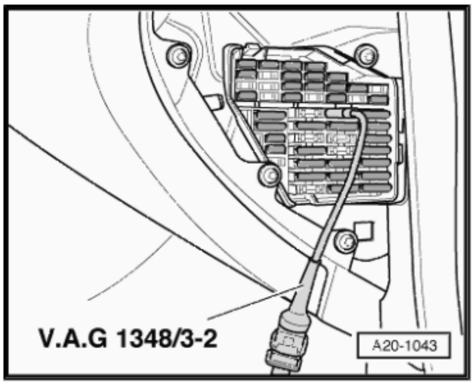
– Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.

– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).

– Press remote control button.

- Fuel pump should start running (noise is audible in vicinity of fuel tank).



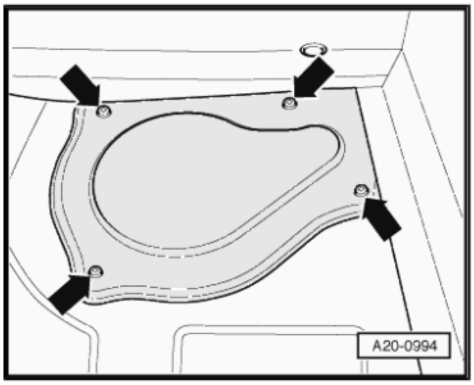
Note

The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

If no noise can be heard from pump:

– Remove luggage compartment floor covering.

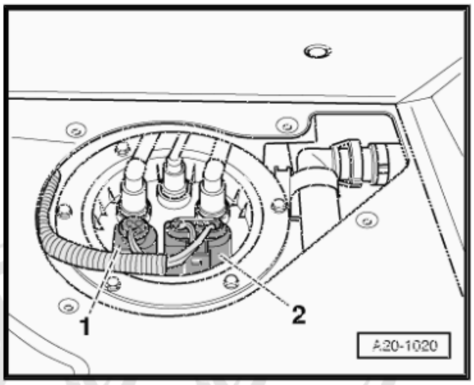
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

Note

Disregard -item 1-.



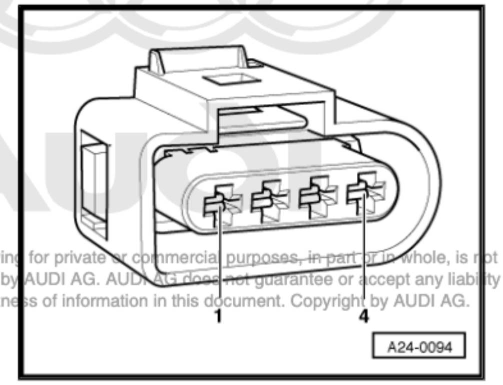
– Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.

– Press remote control button.

- Specification: approx. battery voltage

If specification is not obtained:

– Repair wiring harness according to current flow diagram.



If reading matches specification although no noise can be heard from pump:

– Remove fuel delivery unit (right-side) ⇒ page 42 .

– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

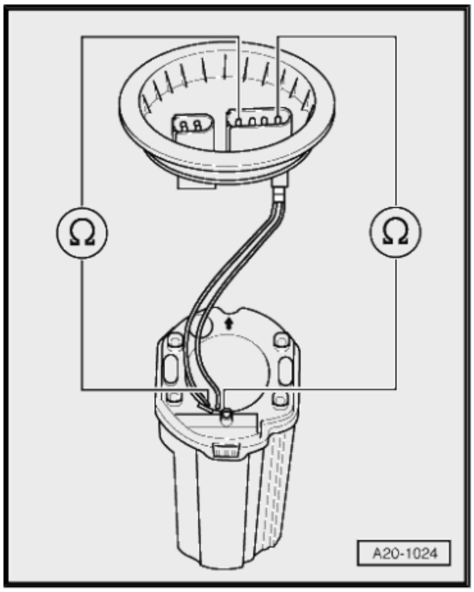
If no faults are found in the wiring:

– Fuel pump is defective. Renew the fuel delivery unit (right-side) ⇒ page 42 .

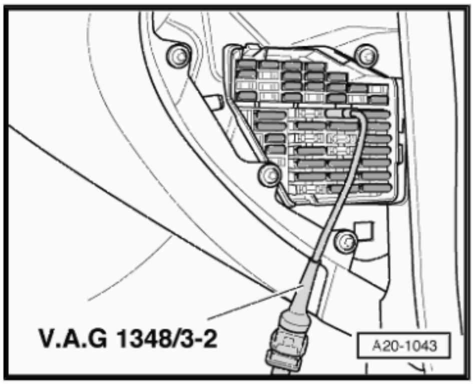
– Install fuel delivery unit (right-side) ⇒ page 48 .

Checking current draw

- Fuel pump voltage supply OK ⇒ page 40



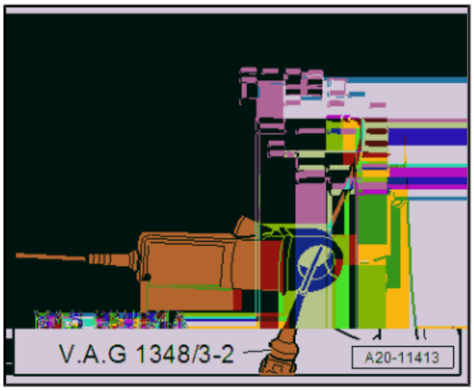
- Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).
- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.
- Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery "+" (positive).



- Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
- Press remote control button.
- Measure current draw of fuel pump.

- Specification: approx. 8 A.

If specification is not obtained:



Note

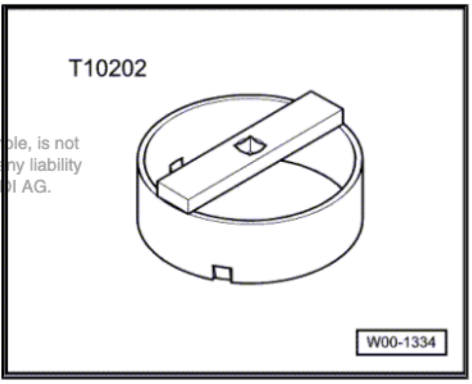
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	♦ Fuel tank empty	– Fill tank
	♦ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 42
0 A	♦ Fuel pump - G23- defective	– Renew fuel delivery unit ⇒ page 42

3.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

- ♦ Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

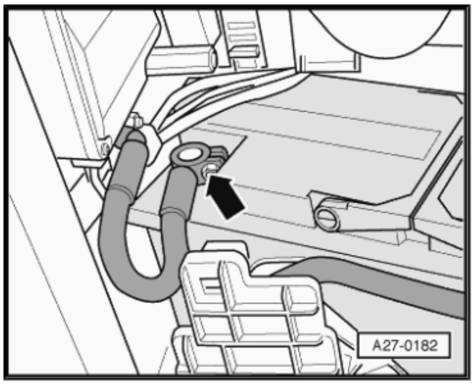
Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 7

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

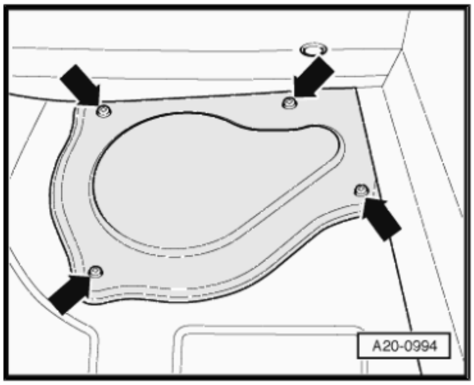


– Remove luggage compartment floor covering.

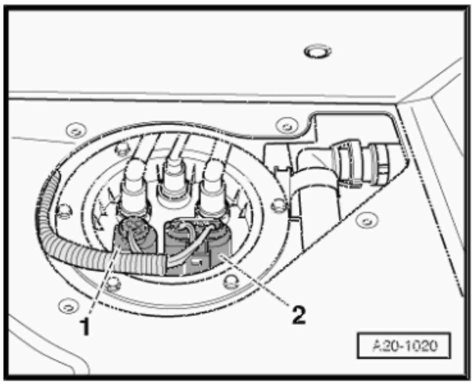
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

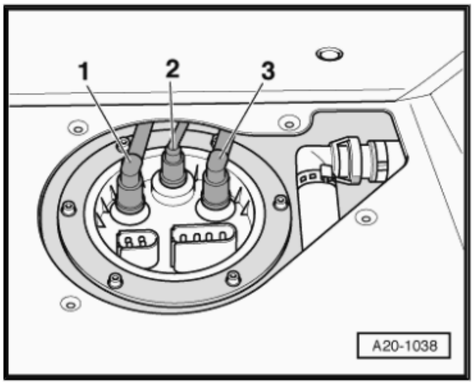
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -3-.



WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

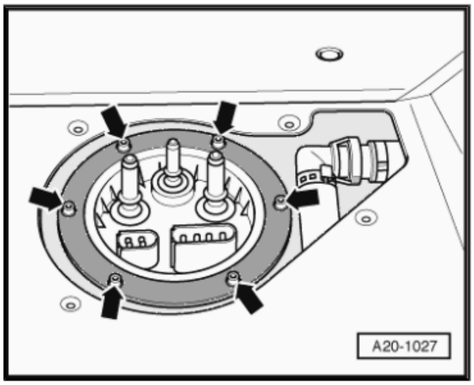
– Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

– In addition, disconnect fuel supply line -2- for auxiliary heater.

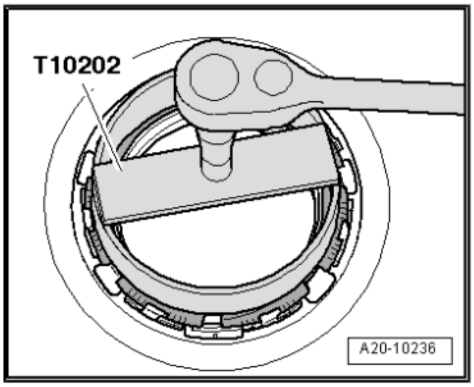
Vehicles up to approx. 10.2002:

– Remove bolts -arrows- and take off locking ring for flange (right-side).



Vehicles from approx. 11.2002 onwards:

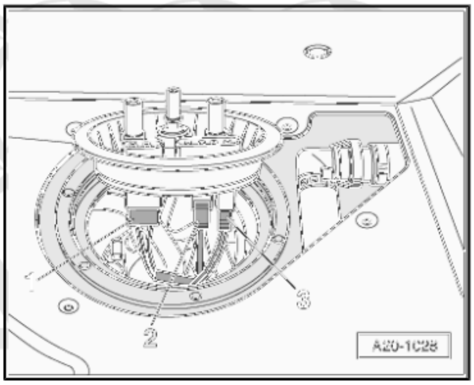
– Unscrew locking ring using wrench - T10202- .



All vehicles (continued):

– Detach flange and remove seal/O-ring.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

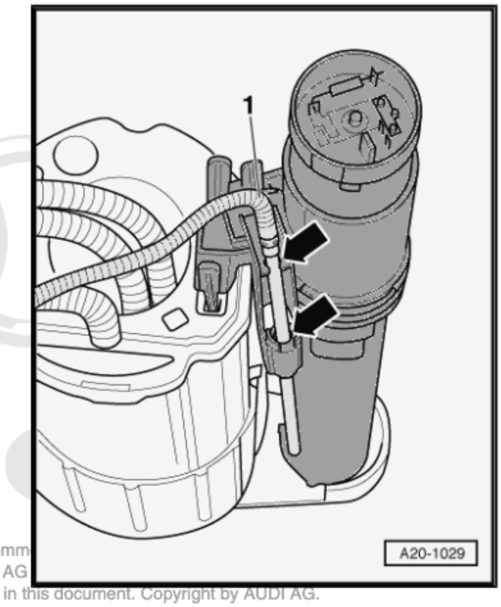


Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

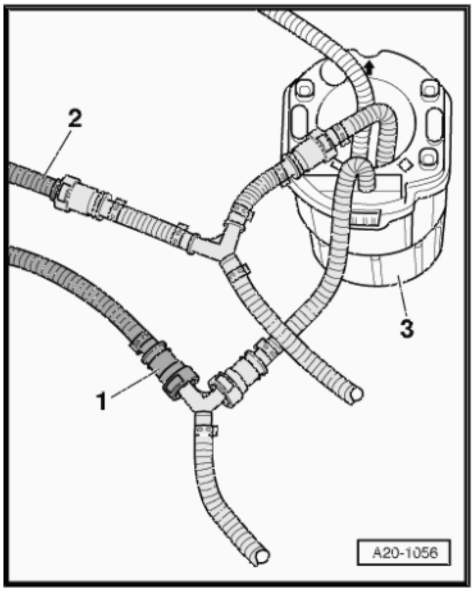
– Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.



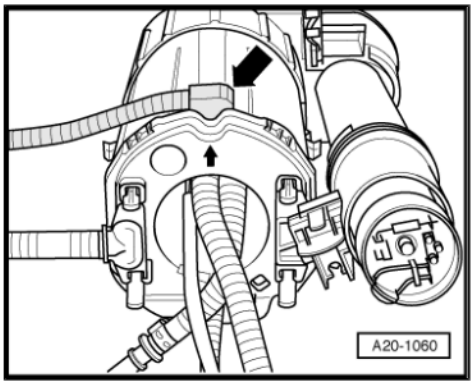
All vehicles (continued):

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

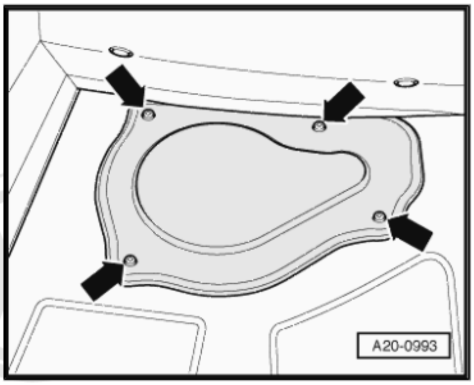
3 - Fuel delivery unit (right-side) with fuel pump - G23-



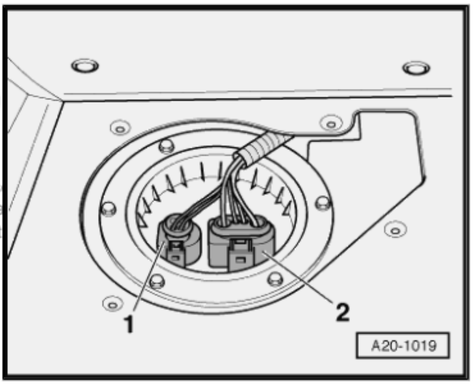
– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



- Detach cover for flange (left-side) -arrows-.

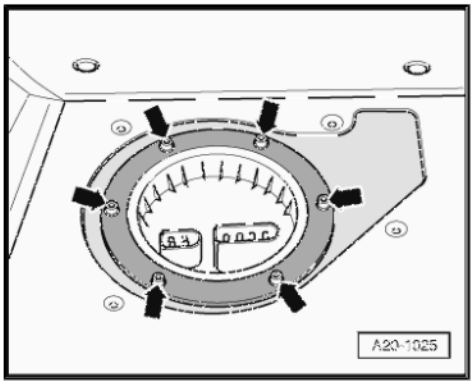


- Unplug electrical connectors -1- and -2- on flange (left-side).



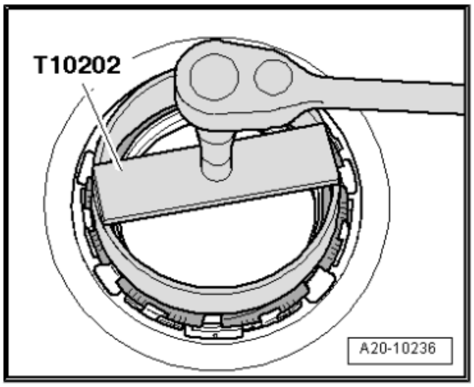
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (left-side).



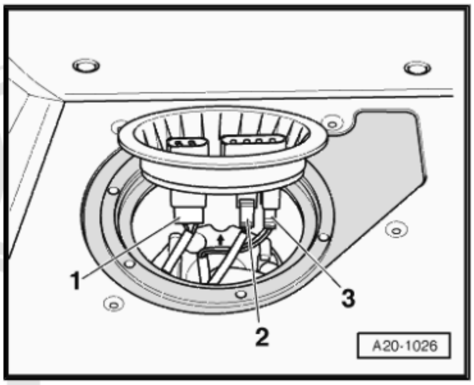
Vehicles from approx. 11.2002 onwards:

- Unscrew locking ring using wrench - T10202- .

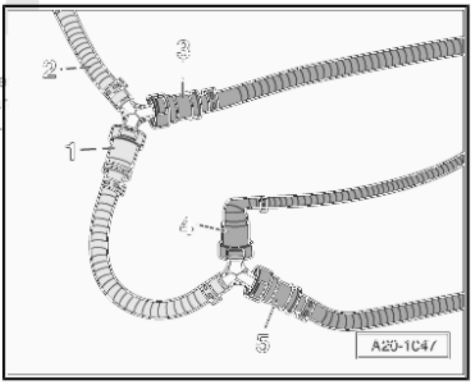


All vehicles (continued):

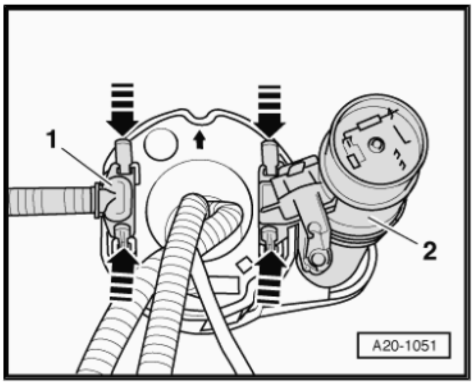
- Detach flange and remove seal/O-ring.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Working through left fuel tank opening, disconnect supply line -3- for suction-jet pump from Y-connector (press release tab).
- Pull supply line for suction-jet pump out of right fuel tank opening.



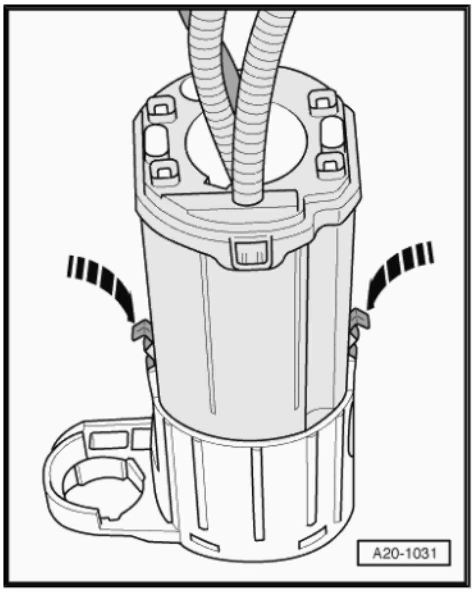
- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

Note

Keep in mind that the fuel delivery unit still contains fuel.

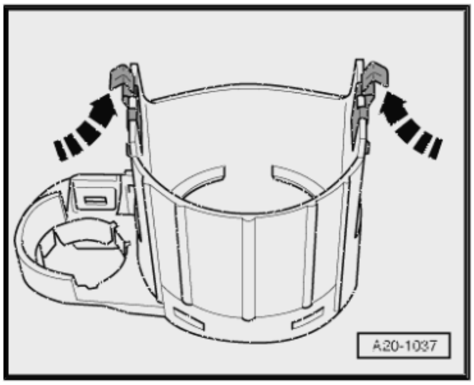


Installing

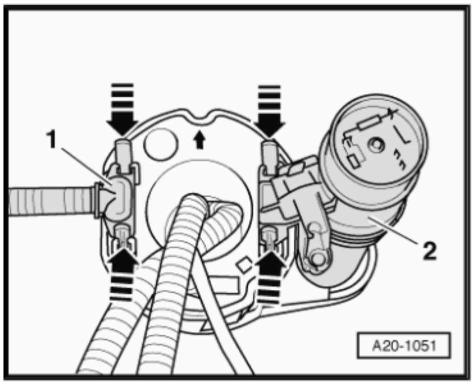
- Tightening torques ⇒ page 36

– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Then press fuel delivery unit carefully into retainer so that it engages audibly.

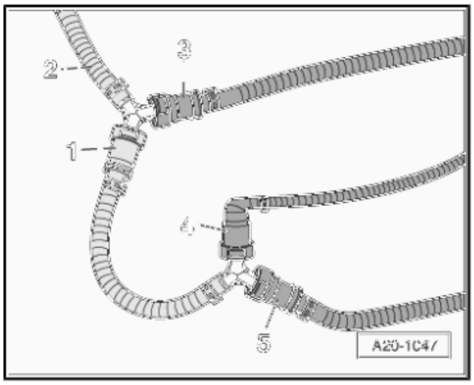


– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).

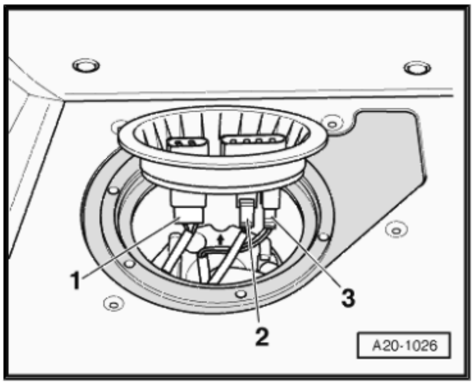


– Push supply line -3- for suction-jet pump through right fuel tank opening into left fuel tank chamber.

– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.



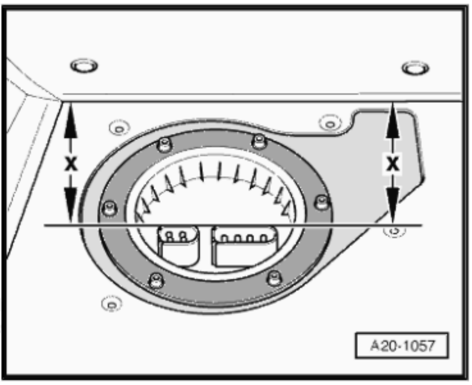
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).



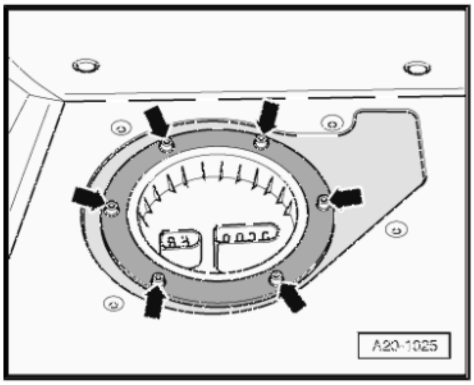
Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

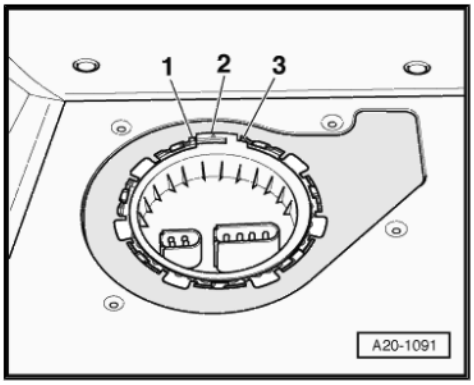


Vehicles from approx. 11.2002 onwards:

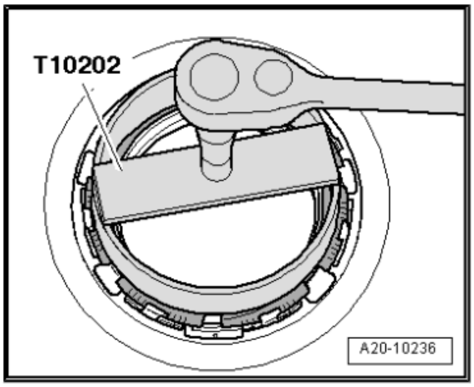
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

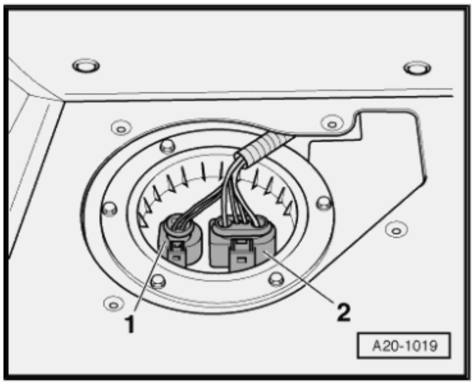


– Tighten locking ring.

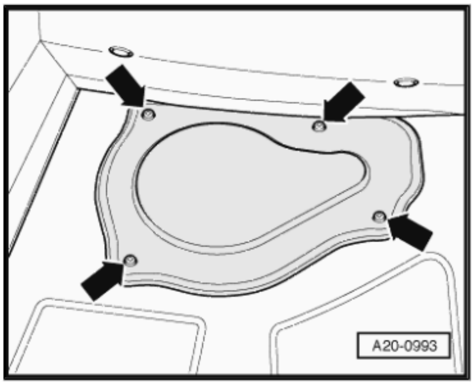


All vehicles (continued):

- Attach electrical connectors -1- and -2- on flange (left-side).

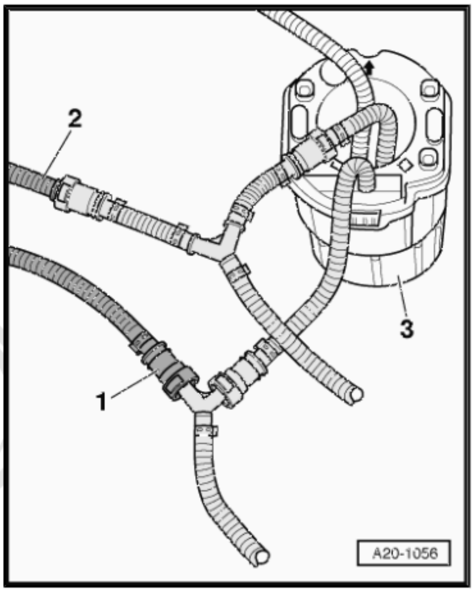


- Secure cover for flange (left-side) -arrows-.



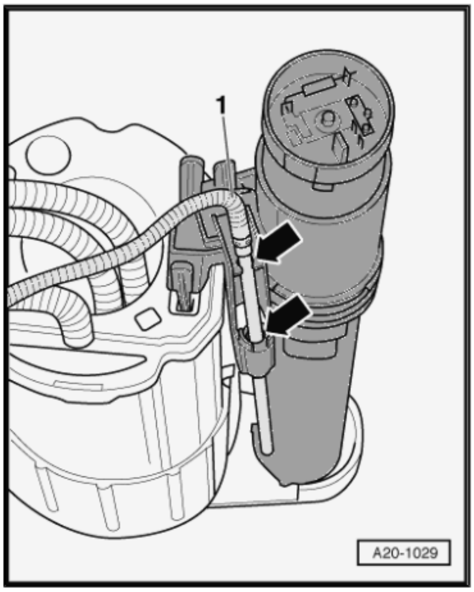
- Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



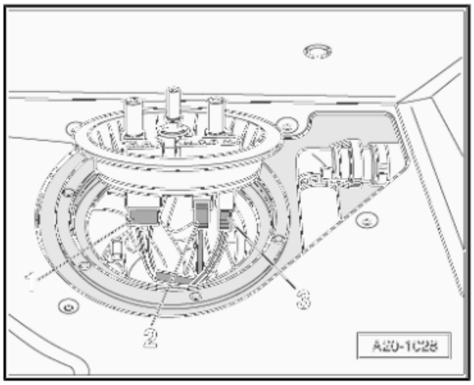
Vehicles with auxiliary heater:

– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

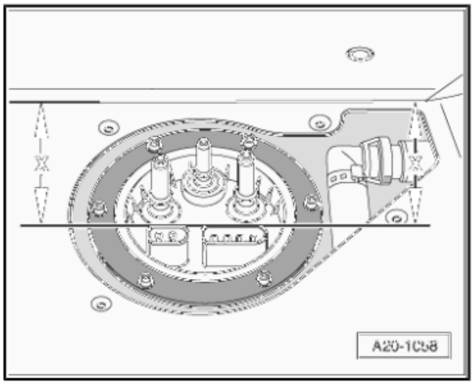
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).



Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



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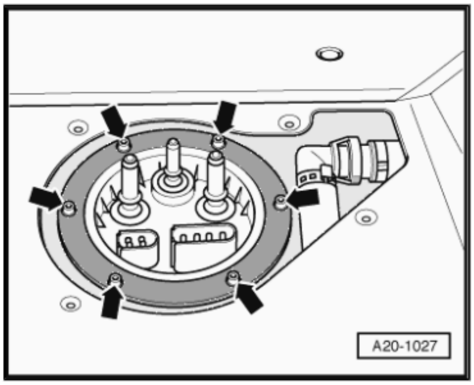
– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.

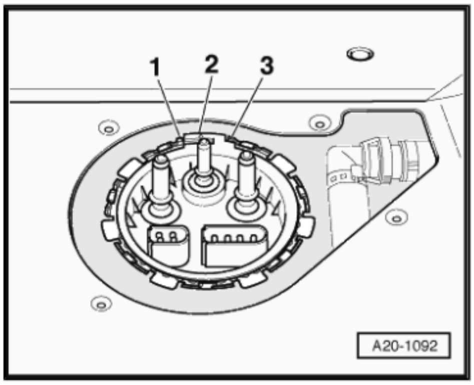


Vehicles from approx. 11.2002 onwards:

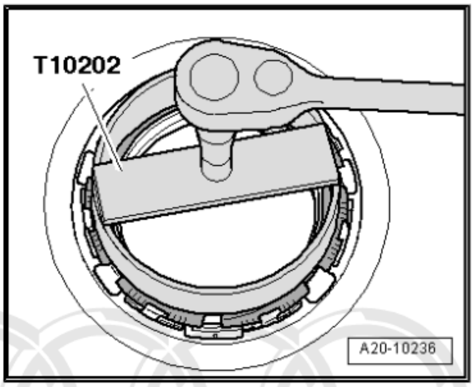
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

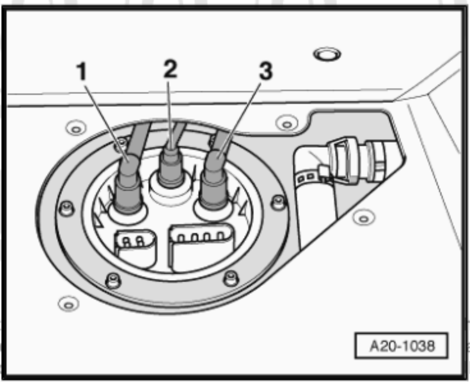


All vehicles (continued):

– Fit fuel return line -1- and fuel supply line -3- so that they engage audibly.

Vehicles with auxiliary heater:

– Also fit supply line -2- going to auxiliary heater so that it engages audibly.



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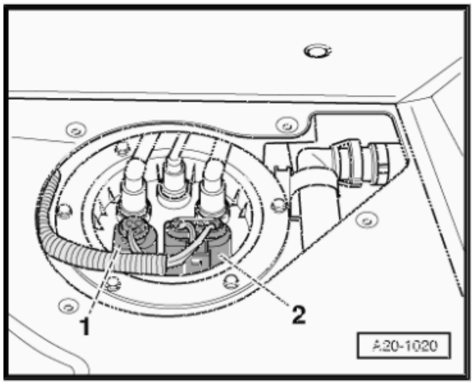
All vehicles (continued):

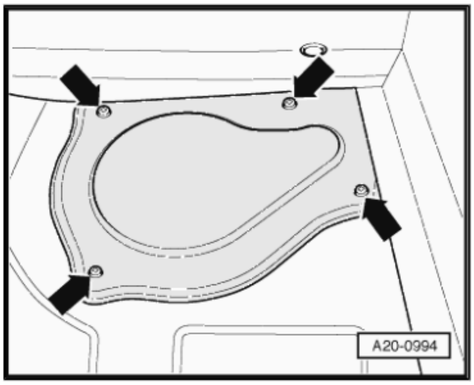
– Attach electrical connectors -1- and -2- on flange (right-side).



- Secure cover for flange (right-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

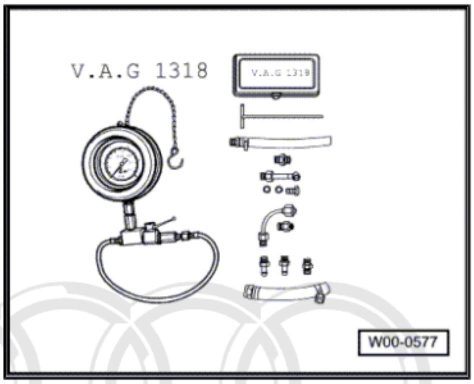
- Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



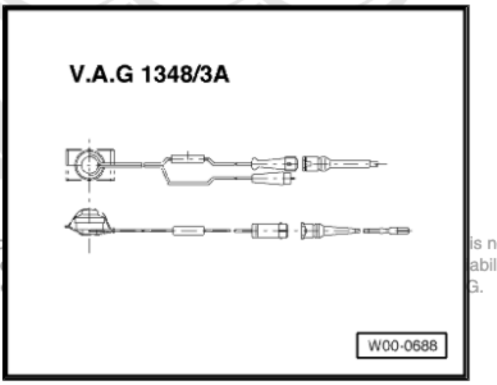
3.7 Checking delivery rate of fuel pumps - vehicles with fuel return line

Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



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- Fuel-resistant measuring container

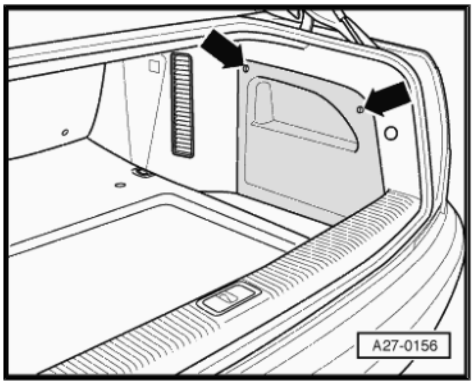
Procedure

- Observe test conditions ⇒ page 3 .

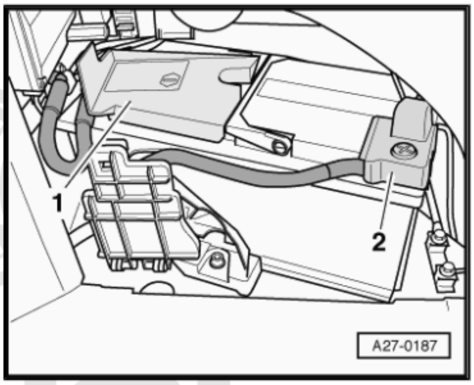
WARNING

Observe safety precautions ⇒ page 1 .

- Remove luggage compartment side trim cover (right-side) -arrows-.



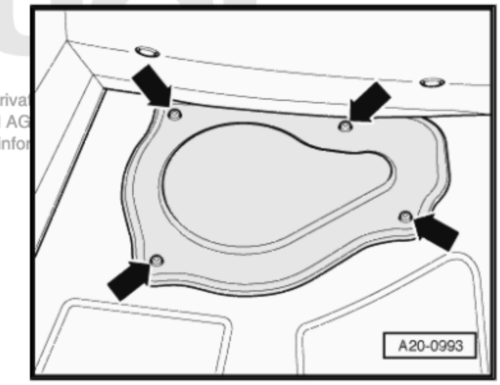
- Remove cover -2- over battery.



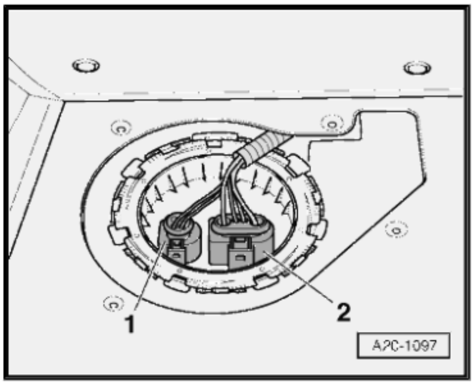
Note

Disregard -item 1-.

- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



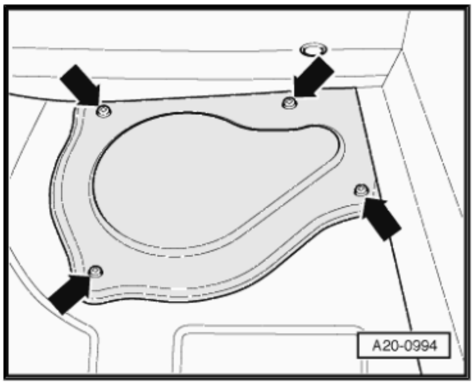
- Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

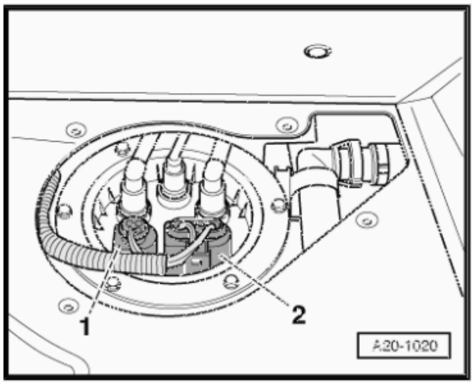
- Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

Note

Disregard -item 1-.



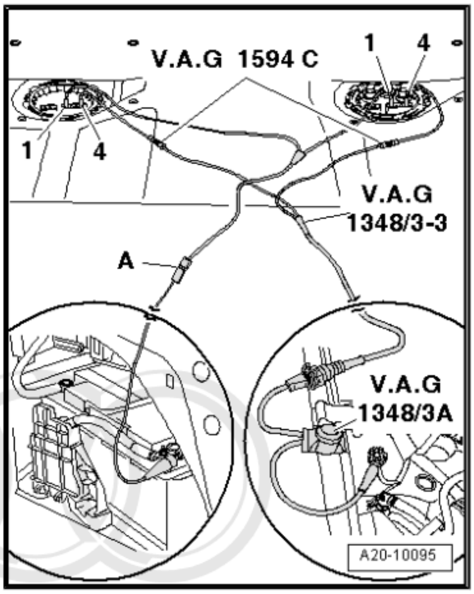
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .

– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.

– Connect crocodile clip to earth point in engine compartment.

– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.

– Remove filler cap from fuel filler neck.

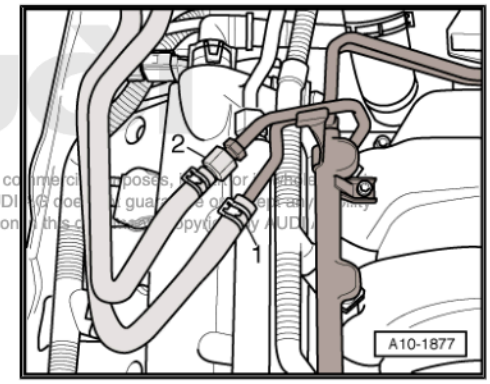


WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

Caution

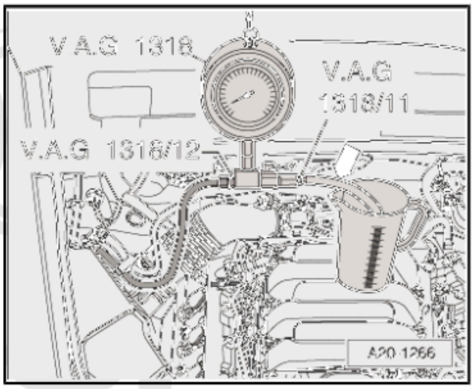
Rules for cleanliness when working on the injection system ⇒ page 3 .



– Disconnect fuel supply line -2- at fuel rail.

Note

Disregard -item 1-.

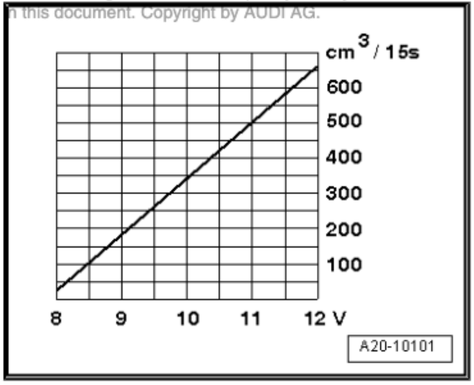


- Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.
- Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.
- Open cut-off valve on pressure tester. Lever must point in direction of flow.
- Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

• Specification: 4 bar

- From this point on do not move position of cut-off valve.
- Empty the measuring container.

- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

Installation is carried out in the reverse order; note the following:

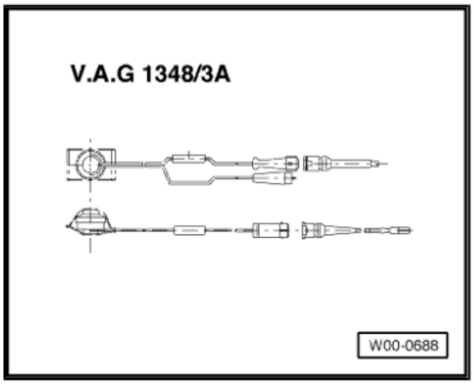
- Secure fuel supply line to fuel rail ⇒ Rep. gr. 24 .

3.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line

Special tools and workshop equipment required

- Adapter -V.A.G 1318/26-

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

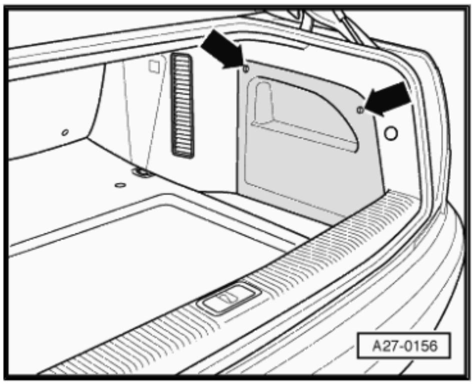
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

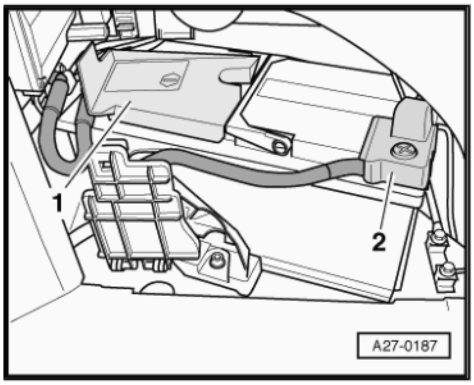
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

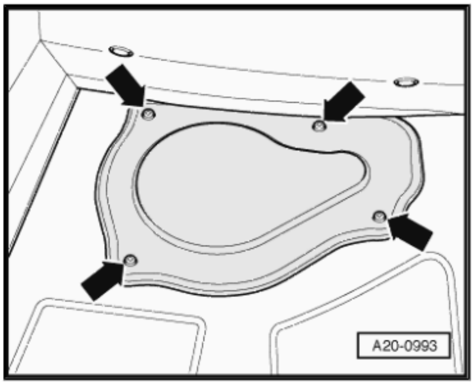
Note

Disregard -item 1-.

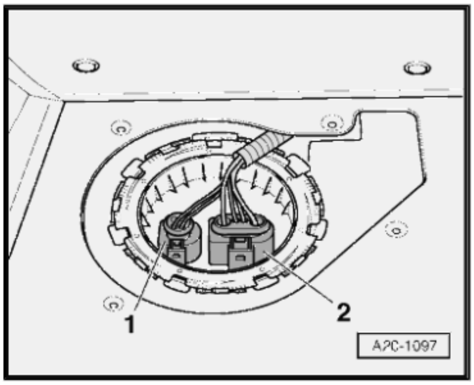


– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



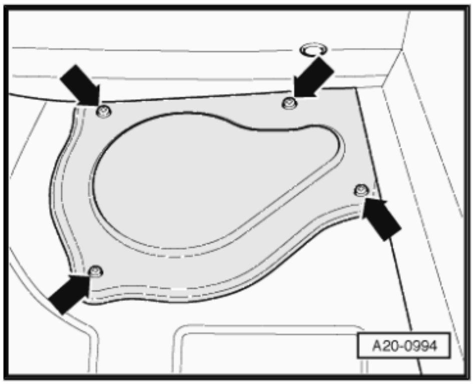
- Unplug electrical connector -2- on flange (left-side).



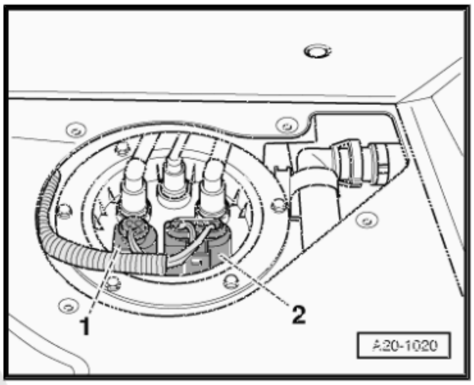
Note

Disregard -item 1-.

- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

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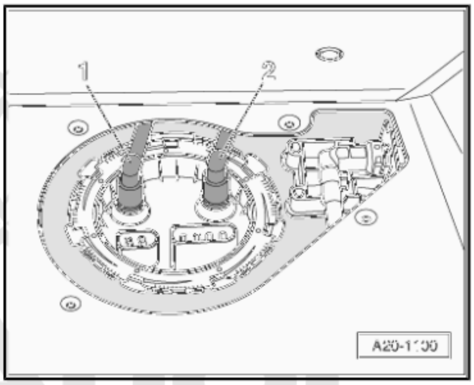
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .

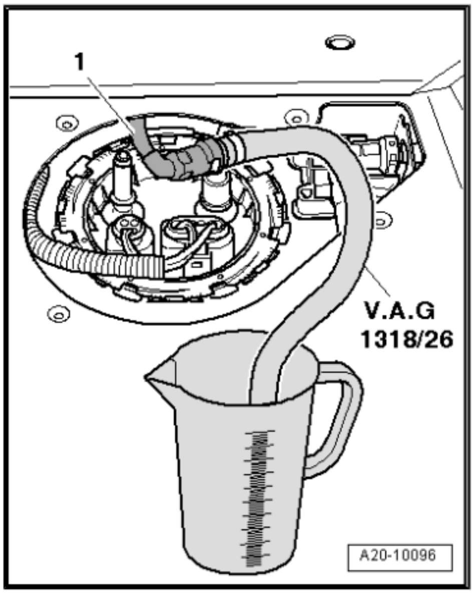


- Disconnect fuel return line -1- from flange by pressing release tabs.

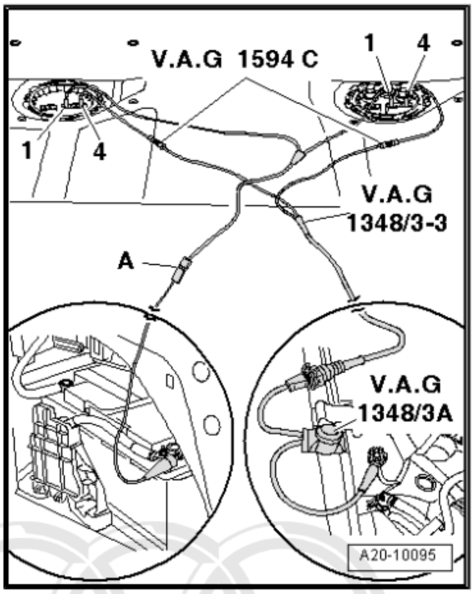
Note

Disregard -item 2-.

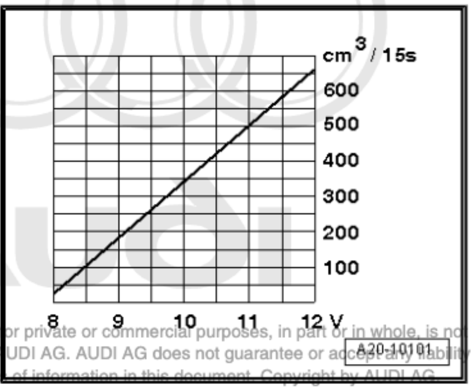
- Fit adapter -V.A.G 1318/26- onto disconnected fuel pipe -1- and hold adapter hose in measuring container.



- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Connect crocodile clip to earth point next to battery.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.



- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pumps are defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

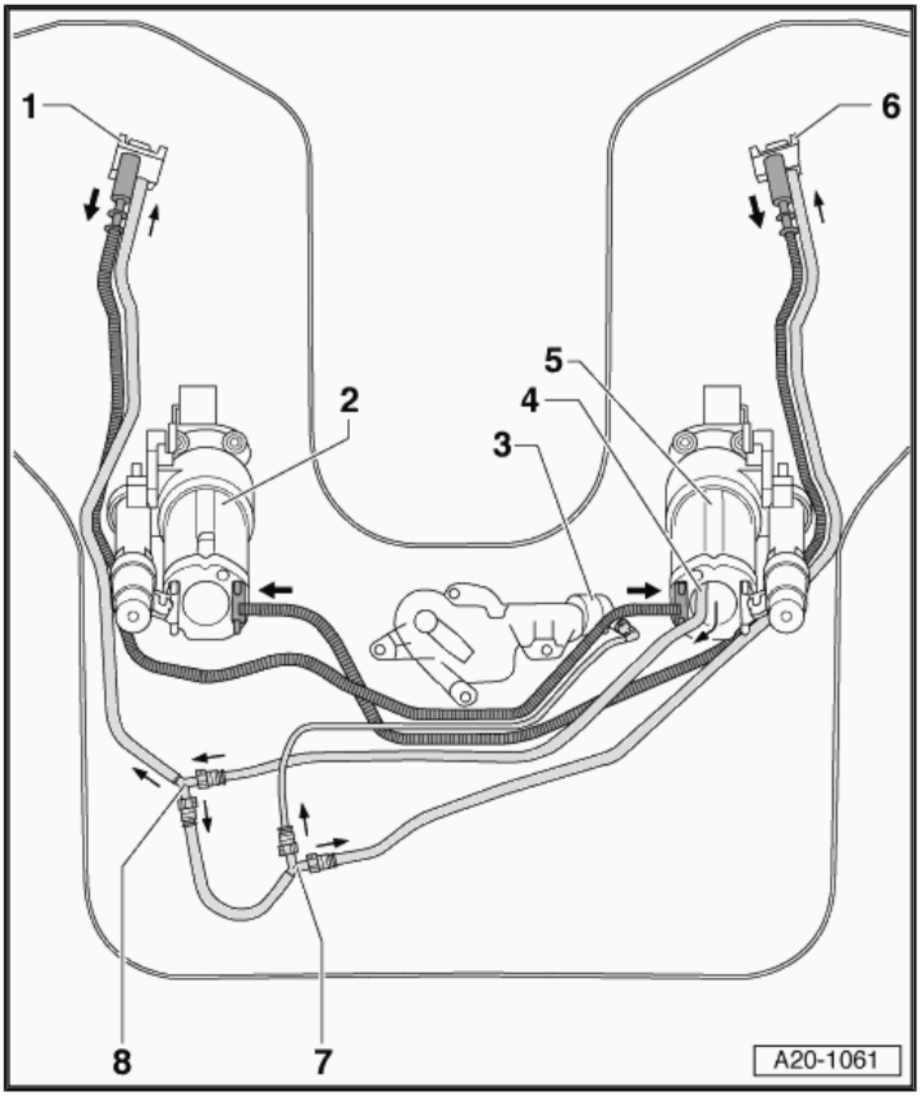
In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

3.9 Suction-jet pumps



1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel pump (right-side)

5 - Fuel delivery unit (right-side)

6 - Suction-jet pump (right-side)

7 - Y-connector

8 - Y-connector

Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

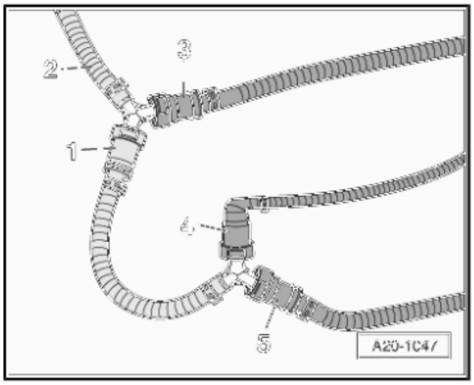
- For this reason, the fuel delivery units -item 2- and -item 5- incorporate a baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the “suction-jet pumps”.
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pump (right-side) -item 4- is passed through a nozzle in the suction-jet pumps -item 1- and -item 6-, and is thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery unit. The suction jet pump (right-side) -item 6- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- The stream of fuel is distributed from the primary stage of the fuel pump (right-side) to the two suction-jet pumps via two Y-connectors -item 7- and -item 8-.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

3.10 Removing and installing suction-jet pump (left-side)

Removing

Observe safety precautions ⇒ page 1 .

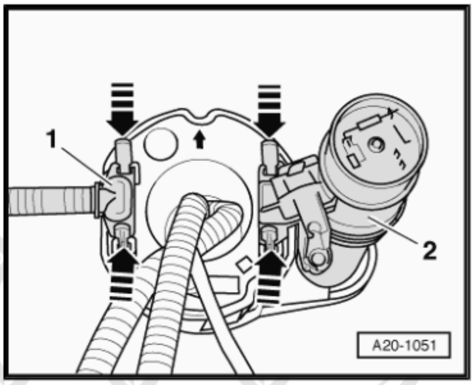
Observe rules for cleanliness ⇒ page 3 .



– Remove the fuel delivery unit (left-side) ⇒ page 26 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Working through left fuel tank opening, disconnect supply lines -1- and -3- for suction-jet pumps from Y-connector (press release tabs).

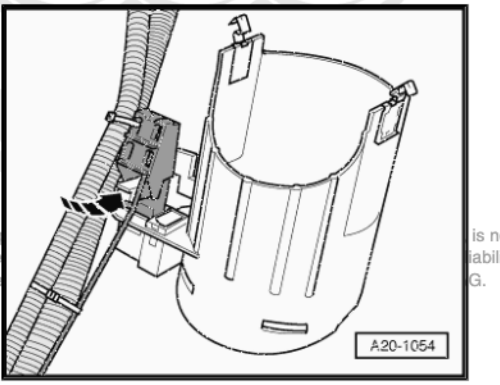


– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.

Note

Disregard -item 2-.

– Pull out disconnected fuel supply line through left fuel tank opening.



– Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

– Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.

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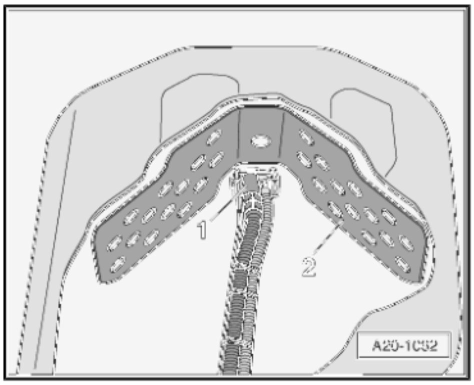
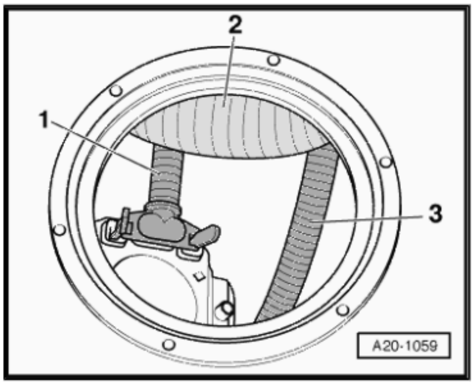


Installing

– Insert suction-jet pump (left-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.

– Then press retaining clip for suction-jet pump into retainer so it engages audibly.

- Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

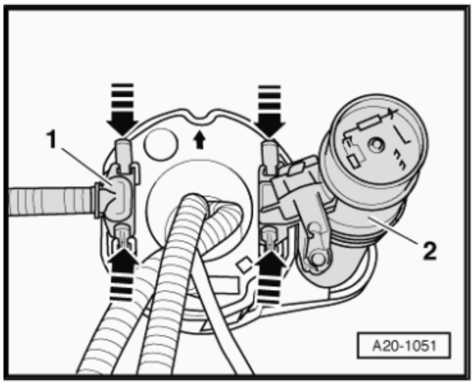


- The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

Note

Disregard -item 1-.

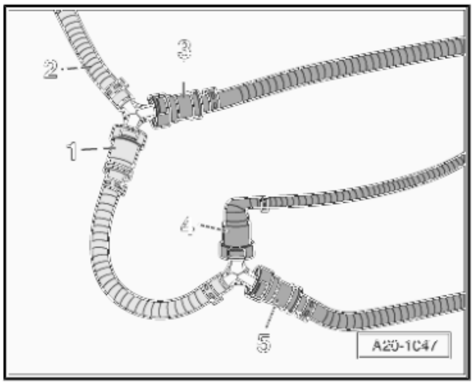
- Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.



Note

Disregard -item 2-.

- Working through left fuel tank opening, fit supply lines -1- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.



- Insert fuel gauge sender 3 - G237- into fuel tank.
- Install fuel delivery unit (left-side) ⇒ page 31 .

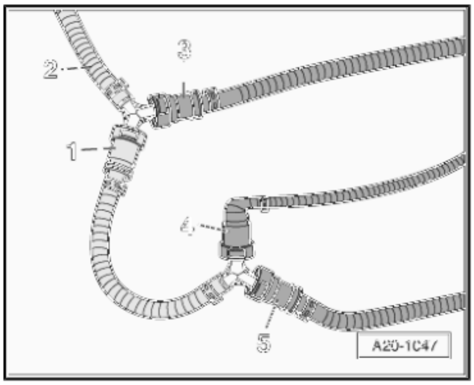
3.11 Removing and installing suction-jet pump (right-side)

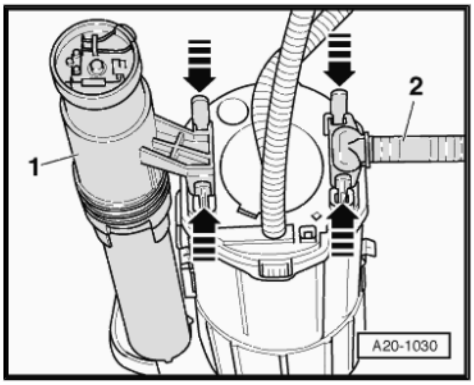
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- Remove fuel delivery unit (right-side) ⇒ page 42 .
- Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
- Working through left fuel tank opening, disconnect supply line -5- for suction-jet pump from Y-connector (press release tab).



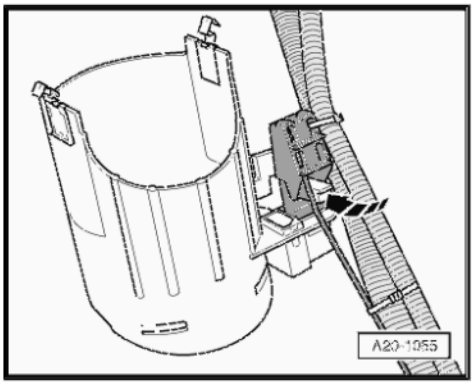


– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.

Note

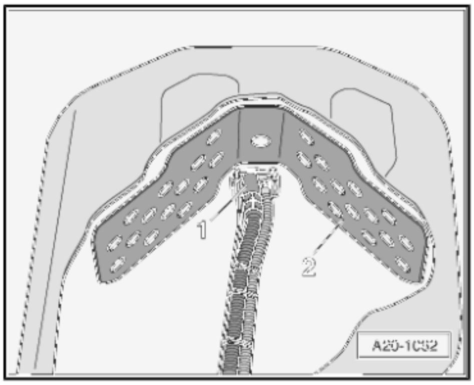
Disregard -item 1-.

– Pull out disconnected fuel supply line through right fuel tank opening.



– Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

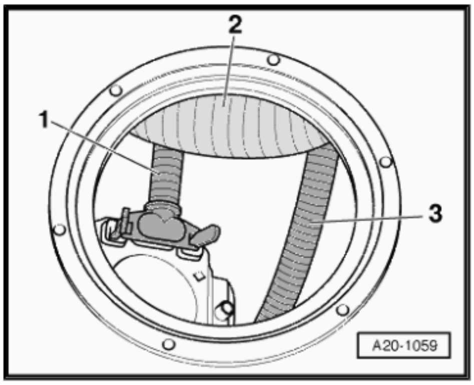
– Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.



Installing

– Insert suction-jet pump (right-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.

– Then press retaining clip for suction-jet pump into retainer so it engages audibly.



– Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

- The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

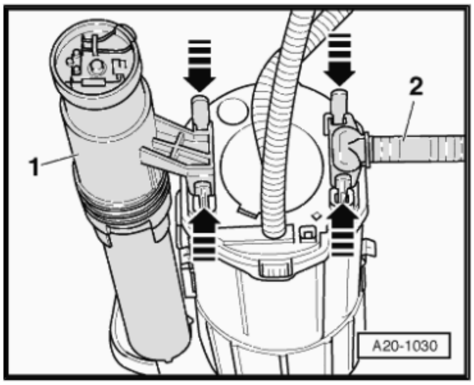
Note

Disregard -item 3-.

– Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.

Note

Disregard -item 1-.

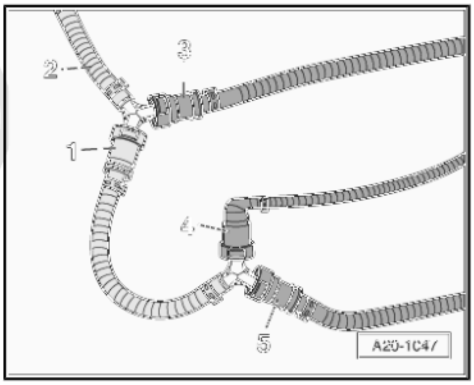


– Push supply line -5- for suction-jet pump through right fuel tank opening into left fuel tank chamber.

– Fit supply line for suction-jet pump onto Y-connector so it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side) ⇒ page 48 .



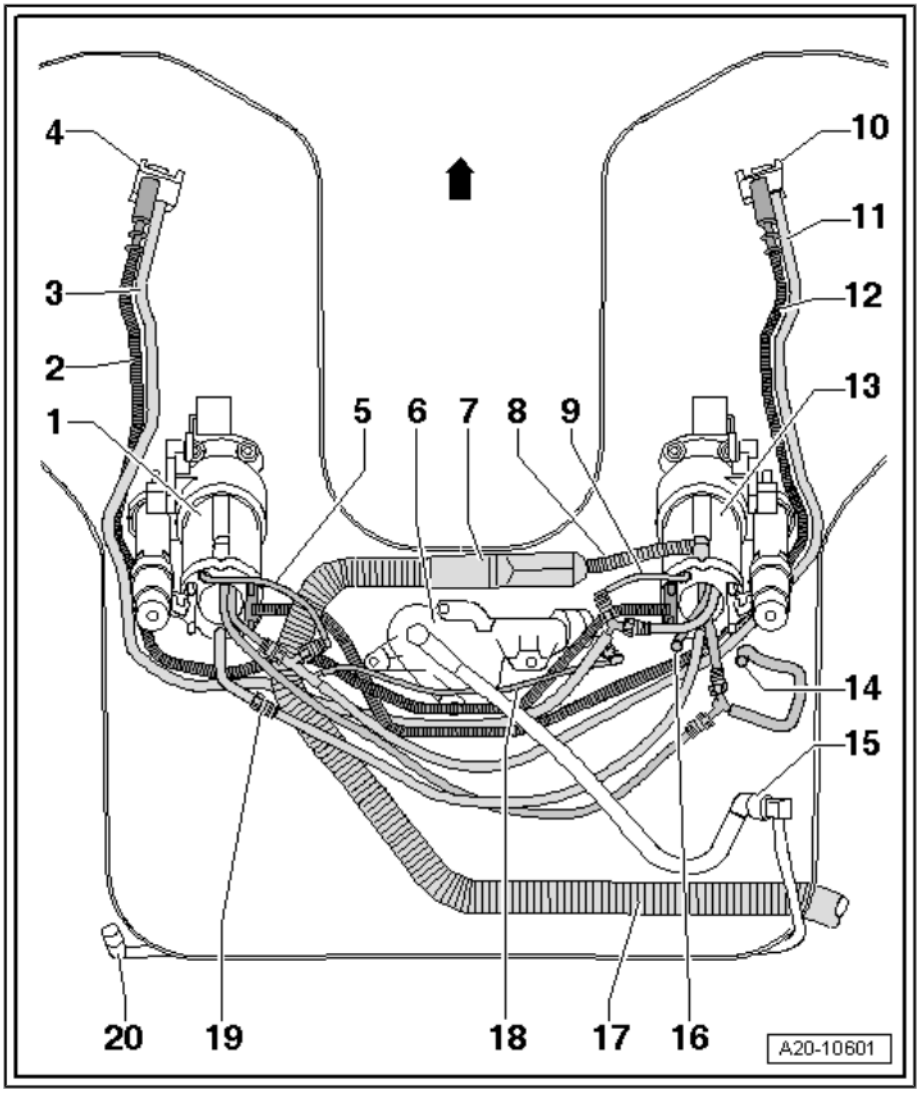
4 Routing of pipes/hoses (inside fuel tank) - rest-of-world vehicles with FSI engine

⇒ “4.1 Routing of pipes/hoses (inside fuel tank) - exploded view”, page 66

4.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 67 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line
  - ☐ From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump
  - ☐ From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Supply line for suction-jet pump
  - ☐ For fuel delivery unit (left-side)

6 - Expansion tank
  - ☐ With suction-jet pump to extract fuel from expansion tank

7 - Non-return flap
  - ☐ For fuel filler pipe

8 - Primary filler pipe
  - ☐ To fuel delivery unit (right-side).
  - ☐ Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

9 - Supply line for suction-jet pump
  - ☐ For fuel delivery unit (right-side)

10 - Suction-jet pump (right-side)

11 - Supply line for suction-jet pump
- ❑ From fuel pump (left-side) to suction-jet pump (right-side)

12 - Fuel supply line
- ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

13 - Fuel delivery unit (right-side) with fuel pump - G23-

14 - Fuel supply line
- ❑ From fuel pumps (left and right) to flange

15 - Breather line
- ❑ To breather connection at top of fuel filler neck

16 - Fuel return line
- ❑ From flange to fuel delivery unit (right-side)
- ❑ Fitted loosely in fuel delivery unit (right-side)

17 - Fuel filler pipe
- ❑ From fuel filler neck to non-return flap in fuel tank

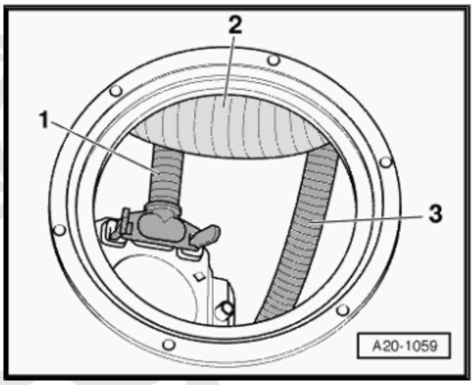
18 - Supply line for suction-jet pump
- ❑ To suction-jet pump in expansion tank

19 - Balance pipe
- ❑ Between fuel delivery units

20 - Breather line
- ❑ To activated charcoal filter in rear left wheel housing

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



5 Fuel delivery unit with fuel pump and fuel gauge senders - rest-of-world vehicles with FSI engine

⇒ “5.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 68

⇒ “5.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 70

⇒ “5.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 70

⇒ “5.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 79

⇒ “5.5 Checking fuel pump G23 (right-side) - electrical test”, page 81

⇒ “5.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 81

⇒ “5.7 Checking delivery rate of fuel pumps - vehicles with 6-cylinder engine”, page 90

⇒ “5.8 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine”, page 94

⇒ “5.9 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)”, page 98

⇒ “5.10 Fuel pump control unit J538 ”, page 102

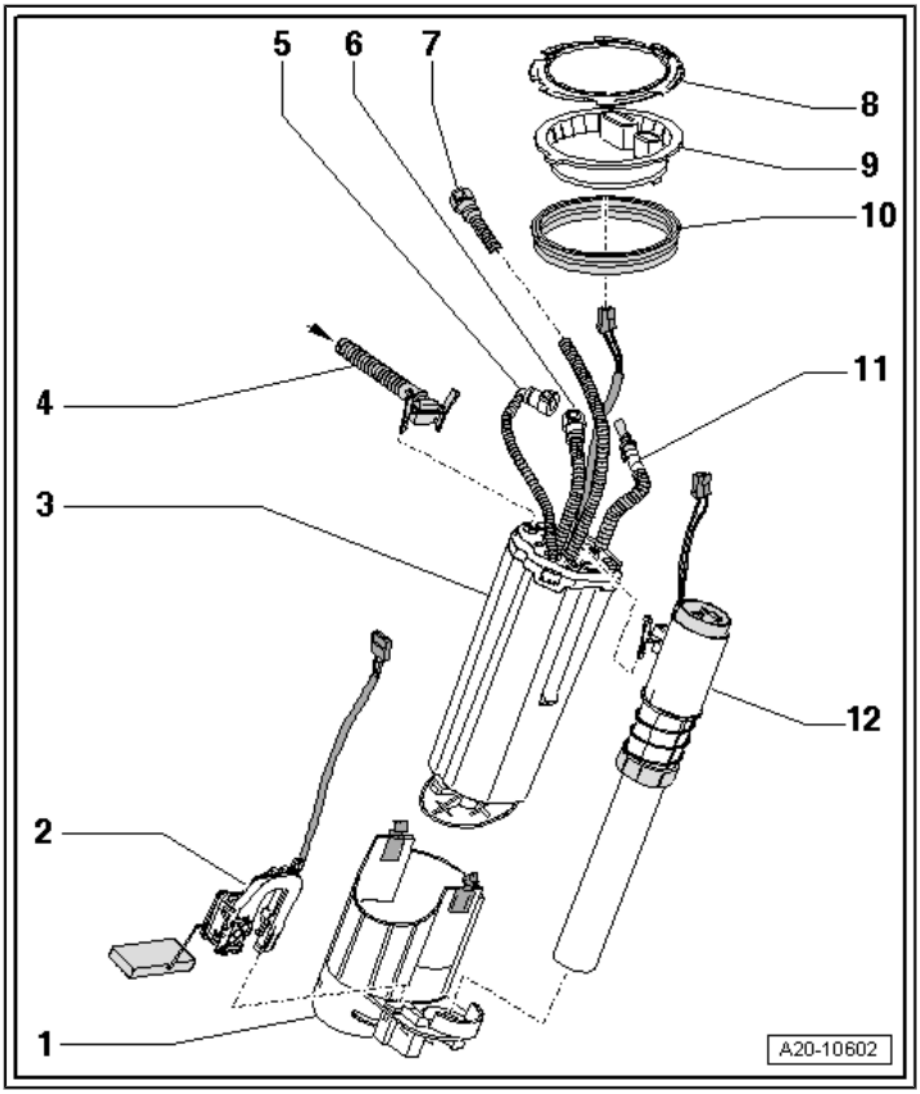
⇒ “5.11 Removing and installing fuel pump control unit J538 ”, page 102

⇒ “5.12 Suction-jet pumps”, page 103

⇒ “5.13 Removing and installing suction-jet pump (left-side)”, page 105

⇒ “5.14 Removing and installing suction-jet pump (right-side)”, page 107

5.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-



1 - Retainer
- ☐ For fuel delivery unit

2 - Fuel gauge sender - G-
- ☐ Black
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 221
- ☐ Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)
- ☐ With fuel system pressurisation pump - G6-
- ☐ Clipped onto retainer -item 1-
- ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ☐ Checking fuel pump (electrical test) ⇒ page 125
- ☐ Checking residual pressure ⇒ Rep. gr. 24
- ☐ Removing and installing ⇒ page 70
- ☐ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line
- ☐ From suction jet pump (right-side)
- ☐ Clipped onto fuel delivery unit -item 3-

5 - Supply line for suction-jet pump
- ☐ For fuel delivery unit (left-side)

6 - Supply line for suction-jet pump
- ☐ To suction-jet pump (right-side)

7 - Fuel supply line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

8 - Locking ring
- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

9 - Flange (left-side)
- ☐ Installation position ⇒ page 70

10 - Seal
- ☐ Renew
- ☐ Install dry

11 - Balance pipe
- ☐ To fuel delivery unit (right-side).

12 - Fuel gauge sender 3 - G237-

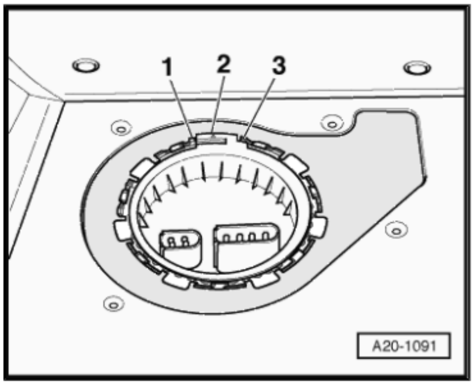
- ☐ Grey
- ☐ Clipped onto fuel delivery unit -item 3-
- ☐ Checking resistance values ⇒ page 225
- ☐ Removing and installing ⇒ page 226

Installation position of flange (left-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



5.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

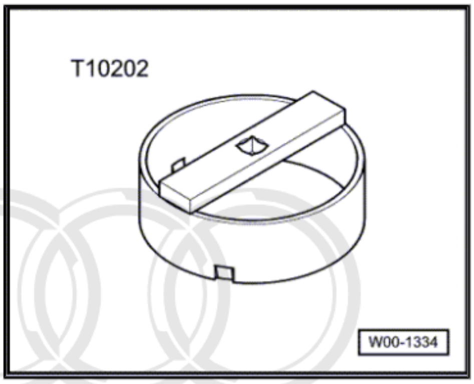
◆ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .

◆ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

5.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

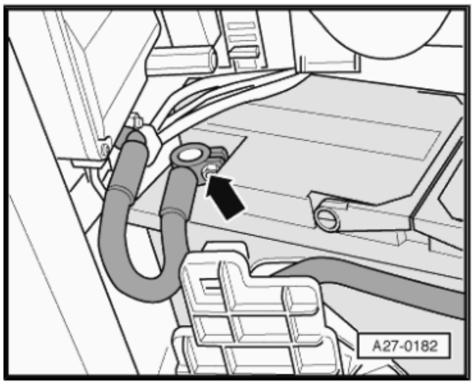
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

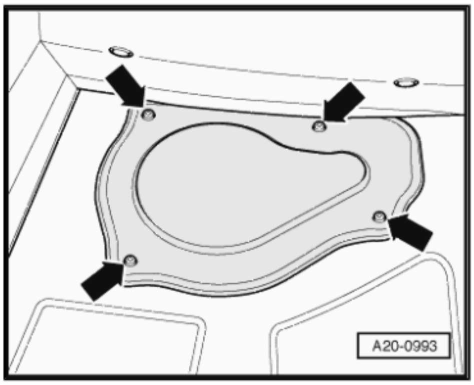


– Remove luggage compartment floor covering.

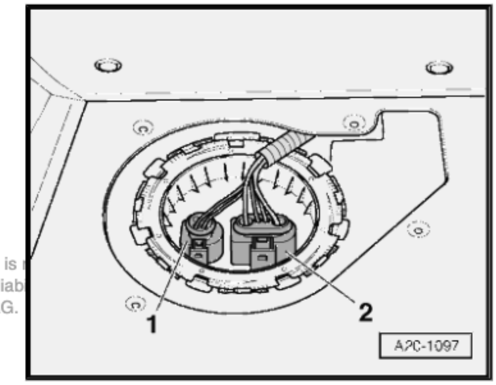
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

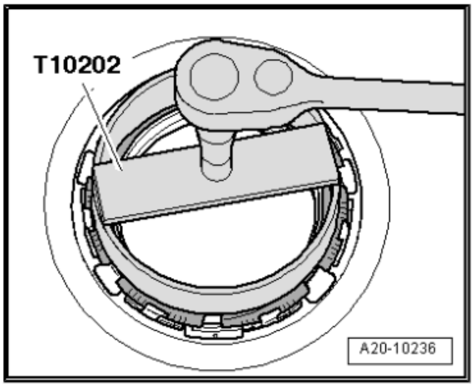
– Detach cover for flange (left-side) -arrows-.



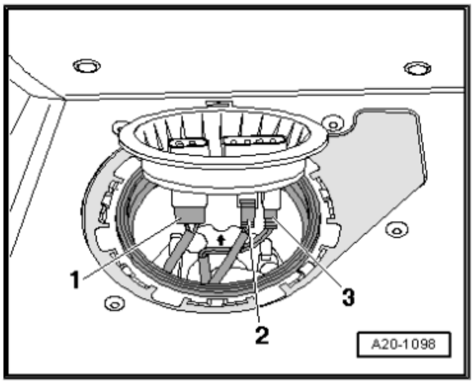
– Unplug electrical connectors -1- and -2- on flange (left-side).



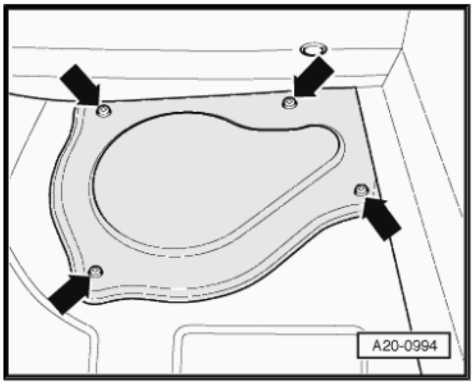
– Unscrew locking ring using wrench - T10202- .



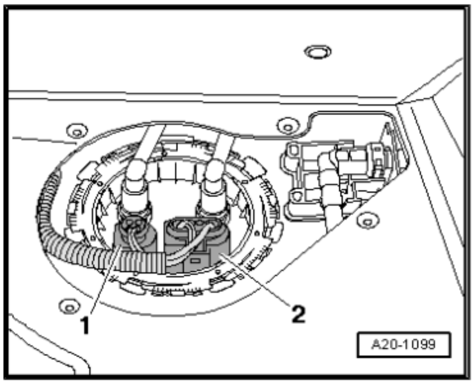
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (right-side).



- Mark fuel return line -1- and fuel supply line -2-.

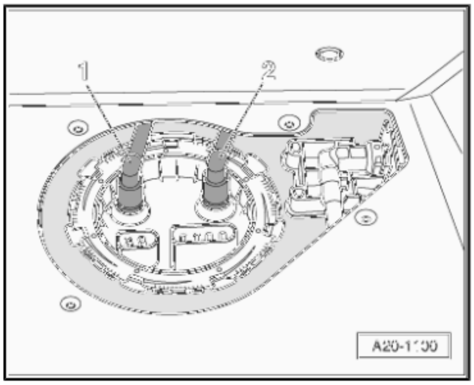
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

- Detach both lines from flange (press release tabs).

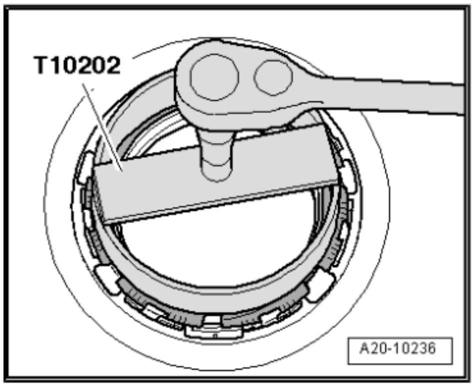
Vehicles with auxiliary heater:

- In addition, disconnect fuel supply line for auxiliary heater.

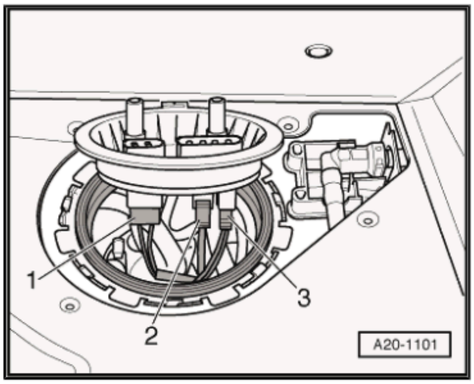


All vehicles (continued):

- Unscrew locking ring using wrench - T10202- .



- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

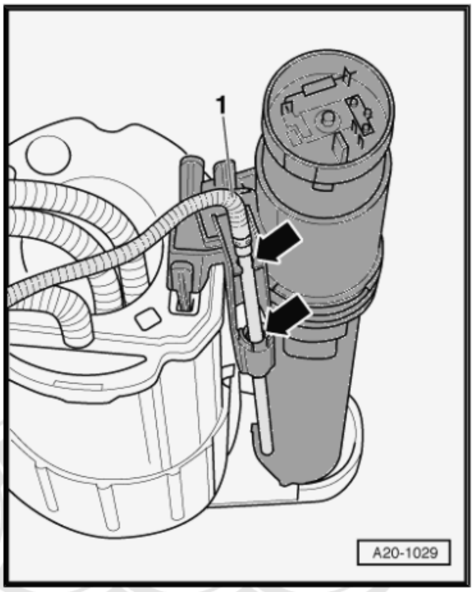


Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

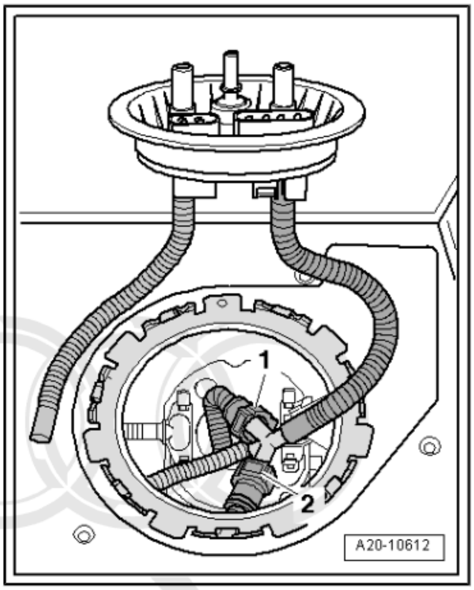
Vehicles with auxiliary heater:

- Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.



All vehicles (continued):

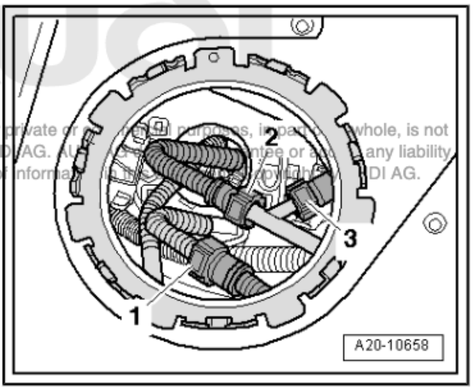
- Working through right fuel tank opening, press release tab and disconnect fuel supply line -2- going to fuel delivery unit (left-side).



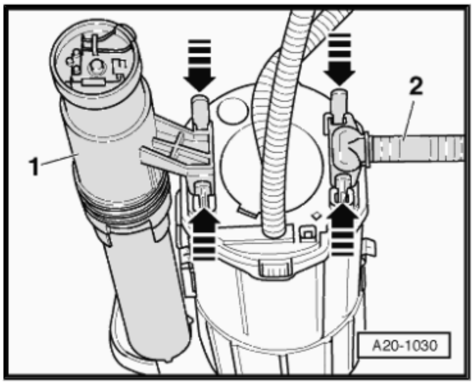
Note

Disregard -item 1-.

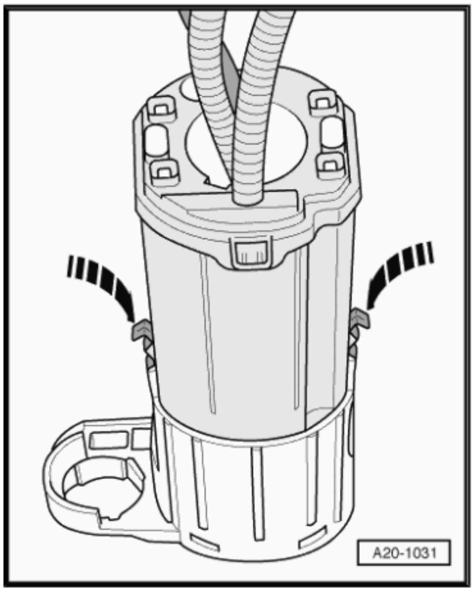
- Working through left fuel tank opening, press release tabs and disconnect balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side).
- Pull disconnected fuel lines out of left fuel tank opening.



- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

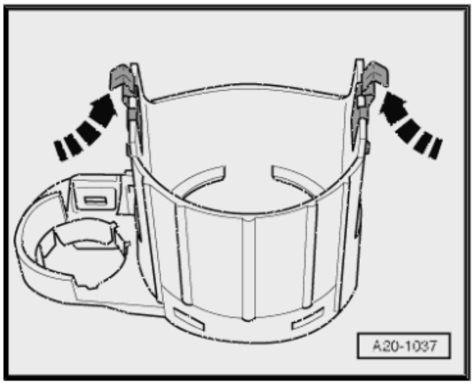


Note

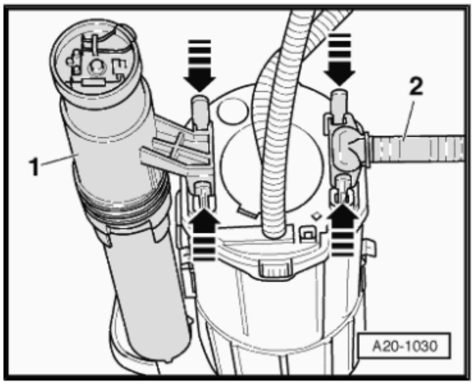
Keep in mind that the fuel delivery unit still contains fuel.

Installing

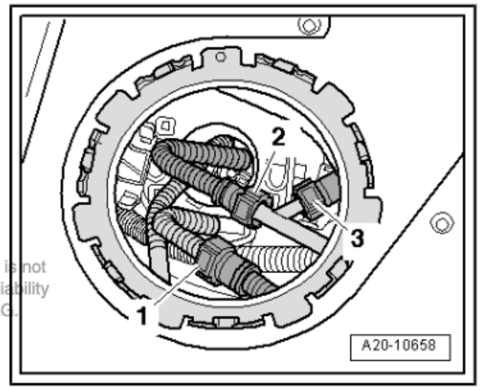
- Tightening torque ⇒ page 68
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



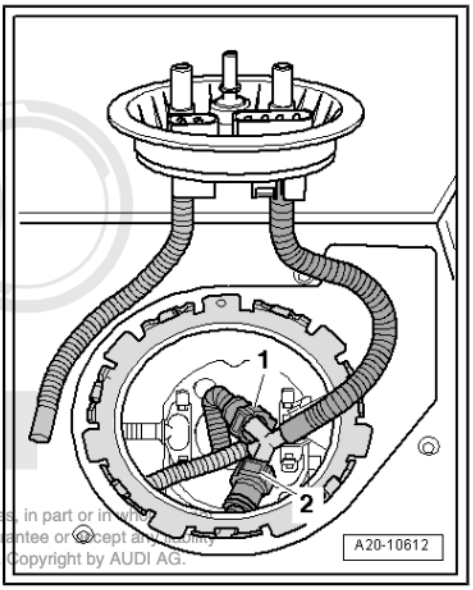
- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
- Guide fuel supply line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



- Working through left fuel tank opening, fit balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side) so that they engage audibly.



– Working through right fuel tank opening, fit fuel supply line -2- so that it engages audibly.

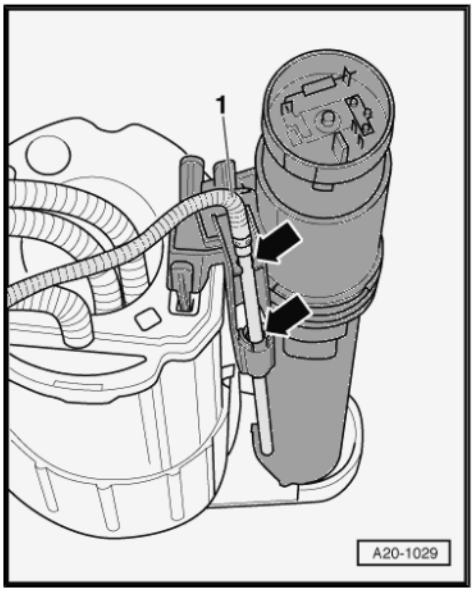


Note

Disregard -item 1-.

Vehicles with auxiliary heater:

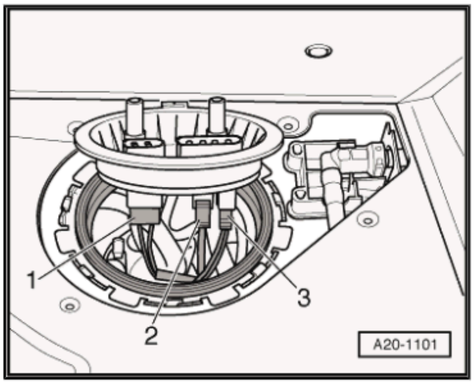
– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

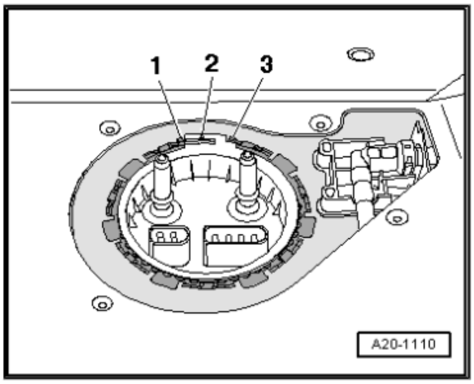
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

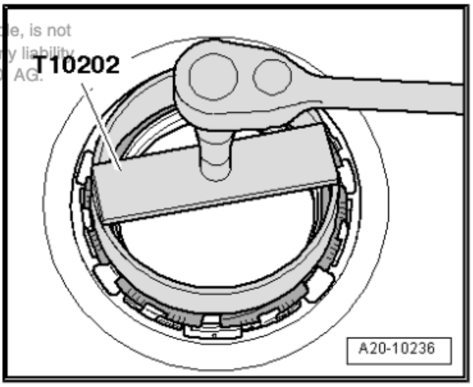


- Fit flange into fuel tank; note correct installation position:

- The hose for the return line must be guided into the opening in the centre of the fuel delivery unit.
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



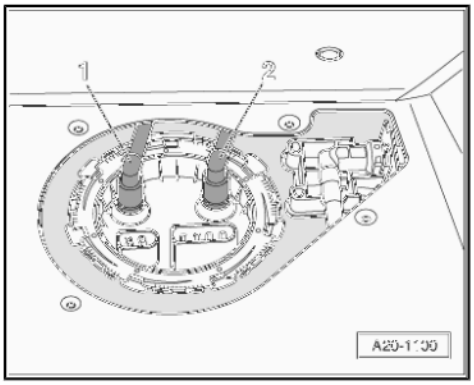
- Tighten locking ring.



- Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

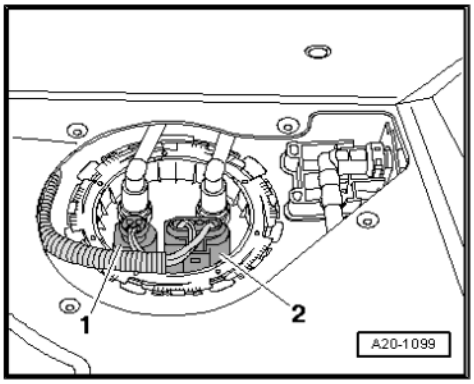
Vehicles with auxiliary heater:

- Also fit fuel supply line going to auxiliary heater so that it engages audibly.

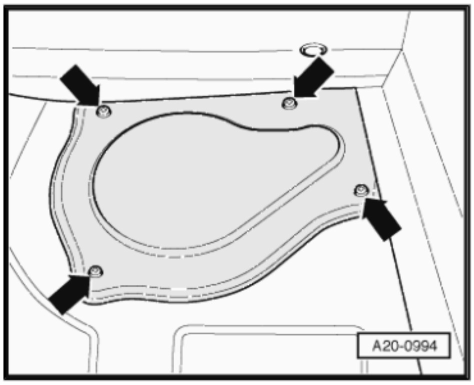


All vehicles (continued):

- Attach electrical connectors -1- and -2- on flange (right-side).

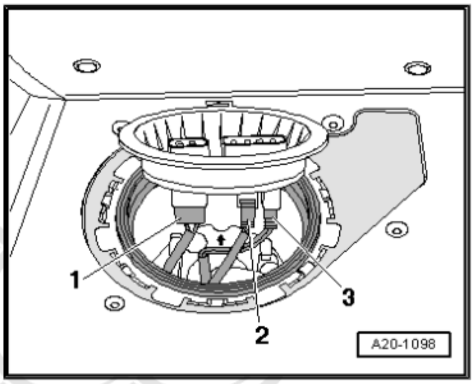


– Secure cover for flange (right-side) -arrows-.



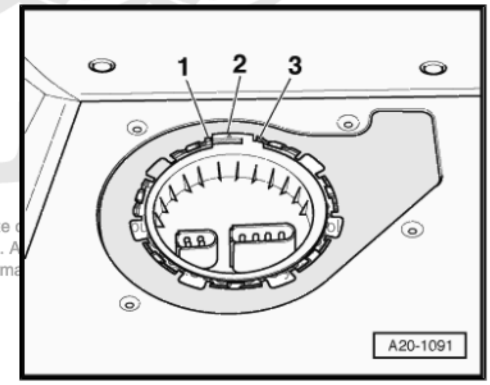
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

– Install new seal for flange (seal must be installed dry).

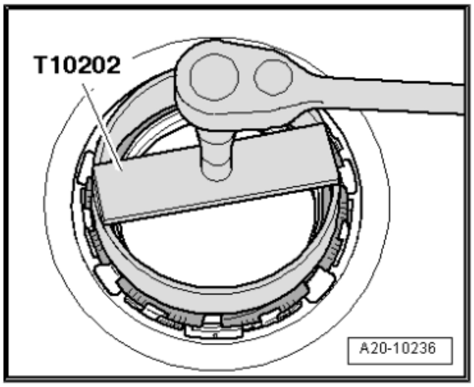


– Fit flange into fuel tank; note correct installation position:

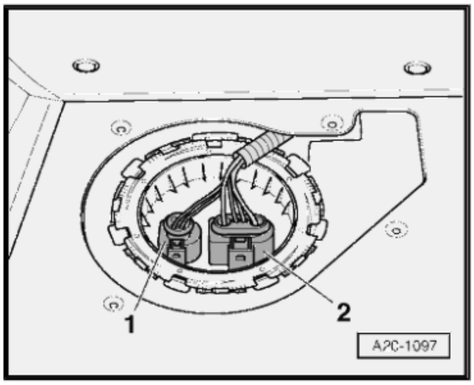
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.



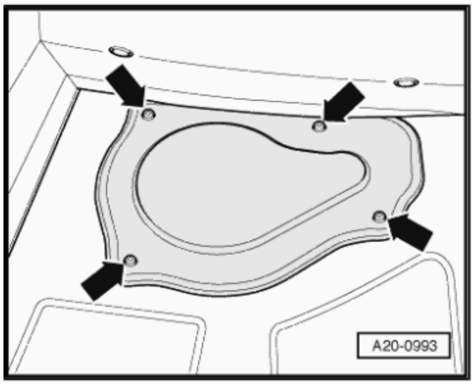
- Attach electrical connectors -1- and -2- on flange (left-side).



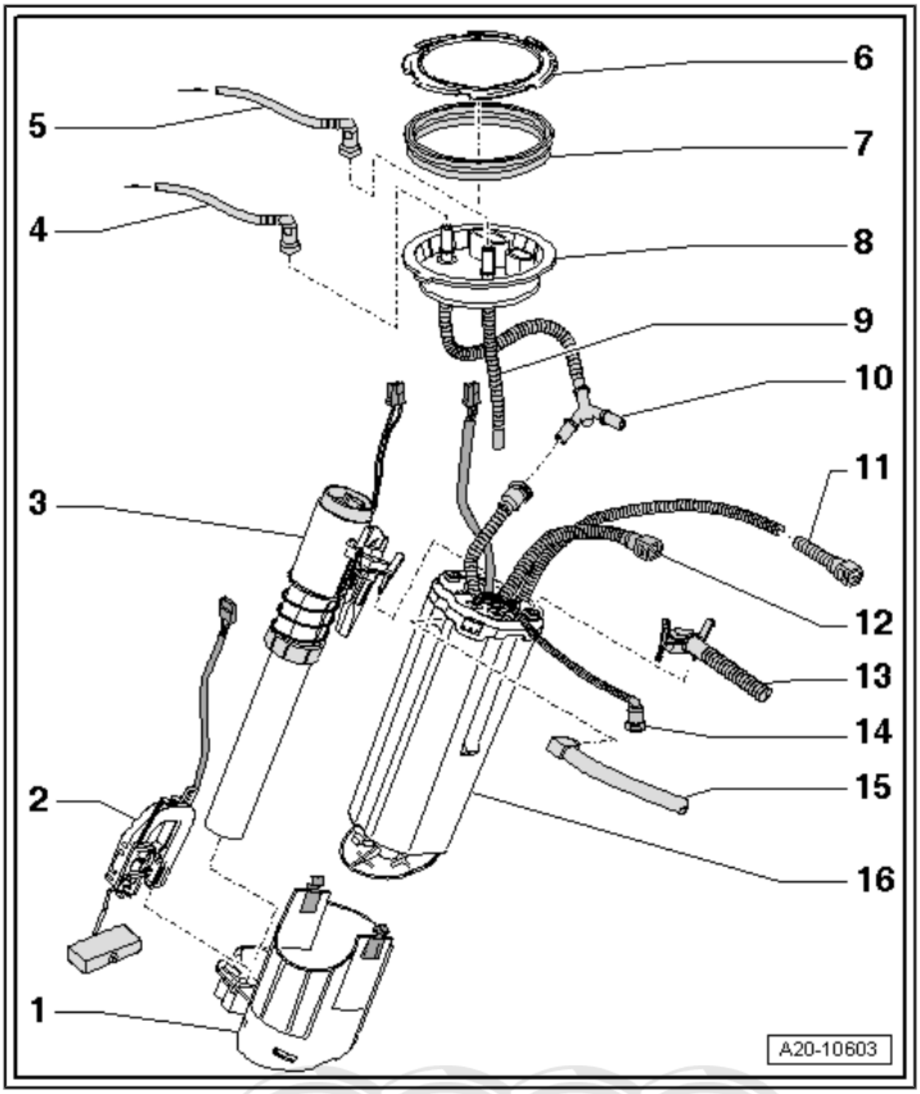
- Secure cover for flange (left-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing

Vehicles with auxiliary heater:

- Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



5.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-



1 - Retainer
- ❑ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-
- ❑ Yellow
- ❑ Clipped onto retainer -item 1-
- ❑ Checking resistance values ⇒ page 223
- ❑ Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 - G393-
- ❑ White
- ❑ Clipped onto fuel delivery unit -item 16-
- ❑ Checking resistance values ⇒ page 230
- ❑ Removing and installing ⇒ page 232

4 - Fuel supply line
- ❑ To fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

5 - Fuel return line
- ❑ From fuel rail
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

6 - Locking ring
- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

7 - Seal
- ❑ Renew
- ❑ Install dry

8 - Flange (right-side)
- ❑ Installation position ⇒ page 81

9 - Fuel return line
- ❑ From flange to fuel delivery unit (right-side)
- ❑ Fitted loosely in fuel delivery unit (right-side)

10 - Fuel supply line
- ❑ From fuel delivery units to flange

11 - Balance pipe
- ❑ Between fuel delivery units

12 - Supply line for suction-jet pump
  - ☐ For suction-jet pump
  - ☐ Press release tab on connection piece to disconnect

13 - Fuel supply line
  - ☐ From suction-jet pump (left-side)
  - ☐ Clipped onto fuel delivery unit -item 16-

14 - Supply line for suction-jet pump
  - ☐ For fuel delivery unit (right-side)

15 - Fuel filler pipe
  - ☐ From filler neck
  - ☐ Clipped onto fuel delivery unit -item 16-

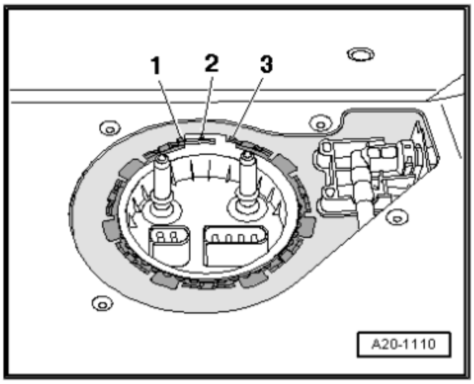
16 - Fuel delivery unit (right-side)
  - ☐ With fuel pump - G23-
  - ☐ Clipped onto retainer -item 1-
  - ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
  - ☐ Checking fuel pump (electrical test) ⇒ page 81
  - ☐ Checking residual pressure ⇒ Rep. gr. 24
  - ☐ Removing and installing ⇒ page 81
  - ☐ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



5.5 Checking fuel pump - G23- (right-side) - electrical test

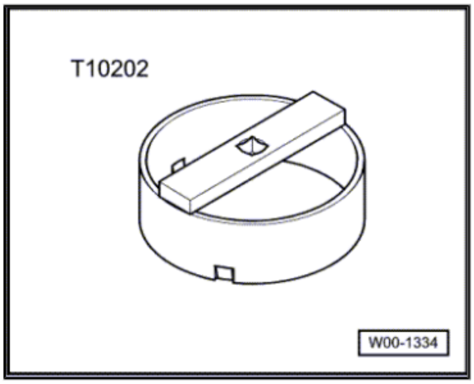
◆ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .

◆ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

5.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

- ◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

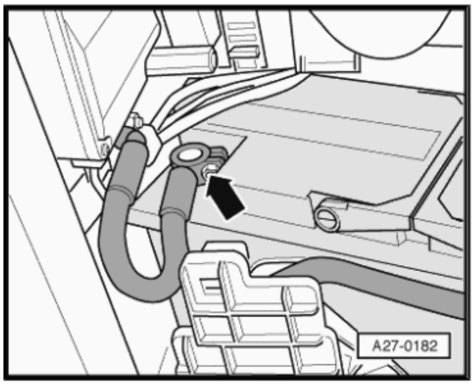
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

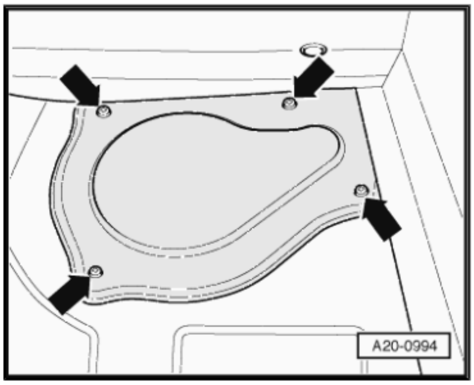


– Remove luggage compartment floor covering.

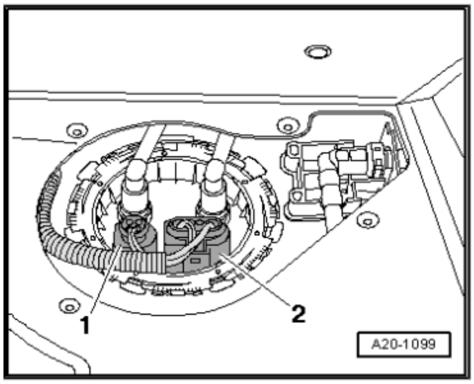
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

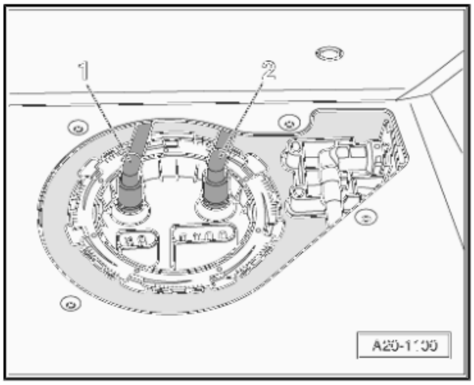


- Unplug electrical connectors -1- and -2- on flange (right-side).



- Mark fuel return line -1- and fuel supply line -2-.

> WARNING
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*



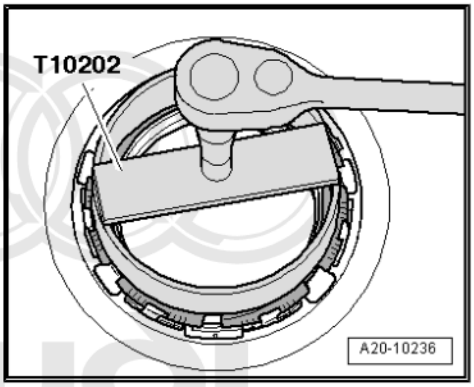
- Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

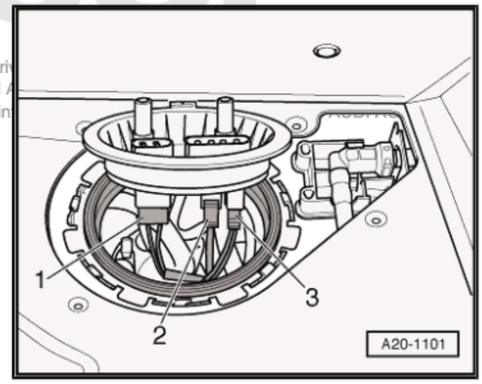
- In addition, disconnect fuel supply line -2- for auxiliary heater.

All vehicles (continued):

- Unscrew locking ring using wrench - T10202- .



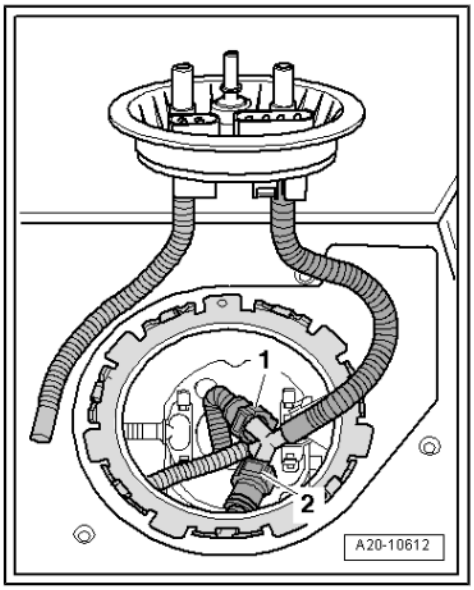
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

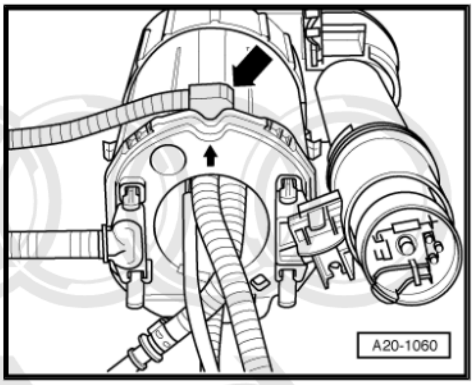
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



Note

For illustration purposes some of the components are shown removed in the following illustrations.

– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



– Detach cover for flange (left-side) -arrows-.

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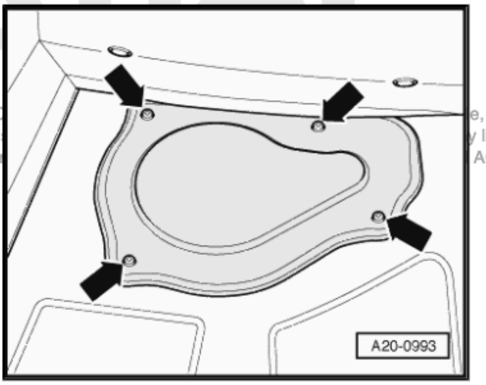
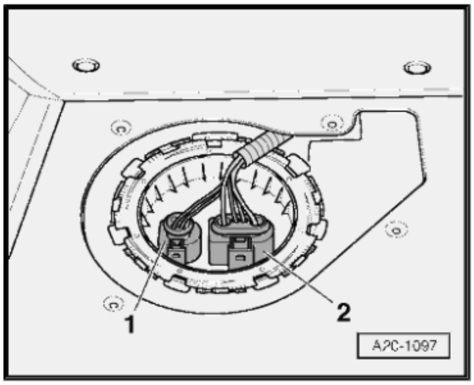
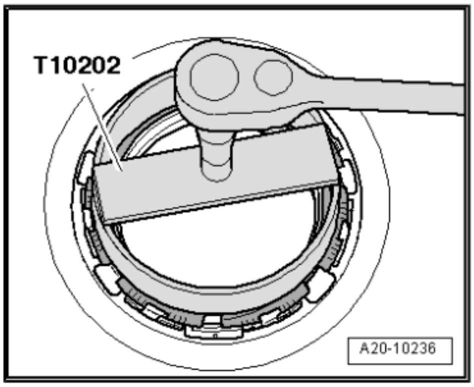


– Unplug electrical connectors -1- and -2- on flange (left-side).

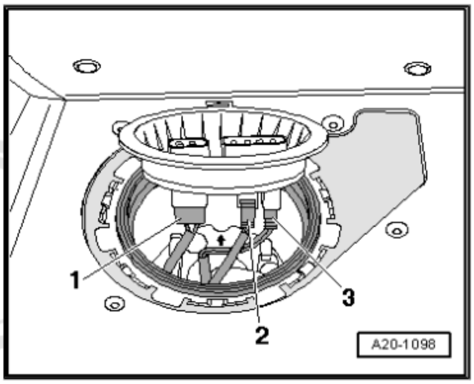


– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (left-side).

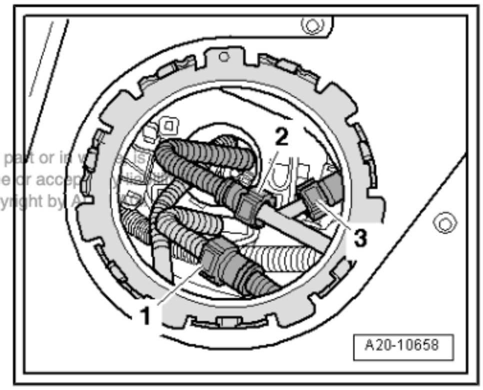


– Working through left fuel tank opening, press release tab and disconnect connecting pipe -1-.

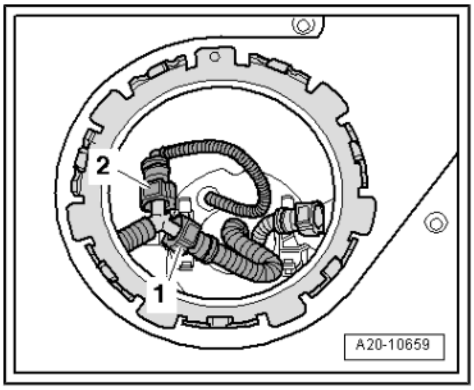
– Pull out connecting pipe from right fuel tank opening.

Note

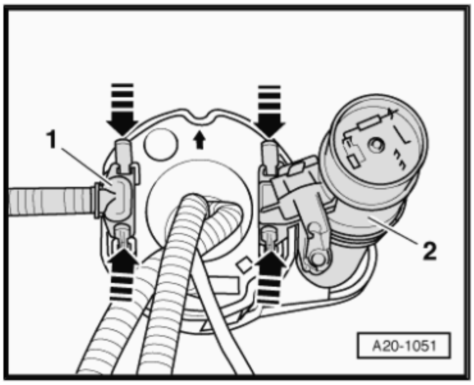
Disregard -items 2, 3-.



– Working through right fuel tank opening, press release tabs and disconnect supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side).



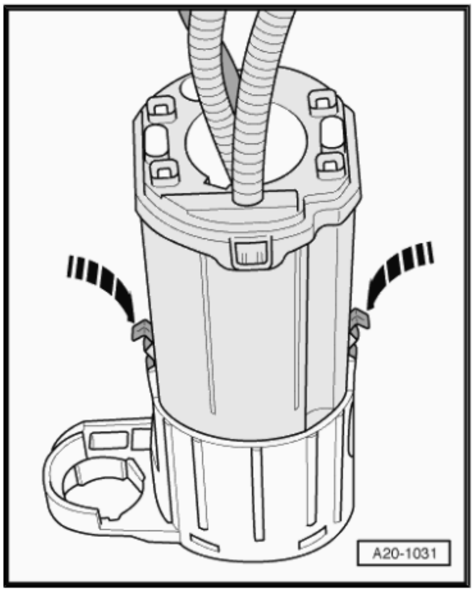
- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

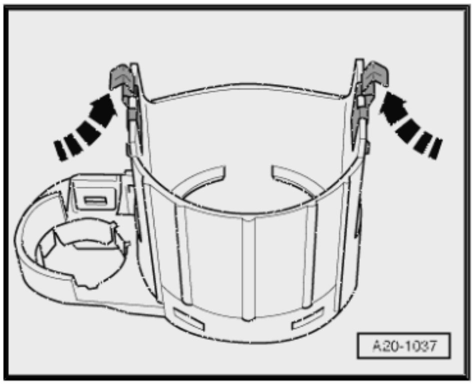
Note

Keep in mind that the fuel delivery unit still contains fuel.

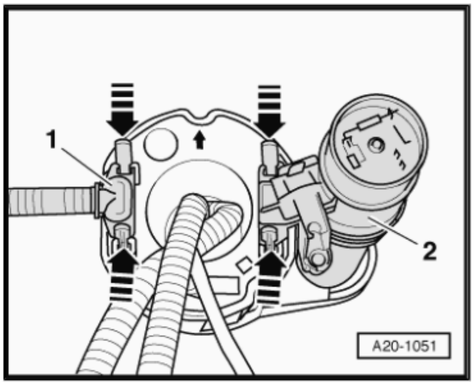


Installing

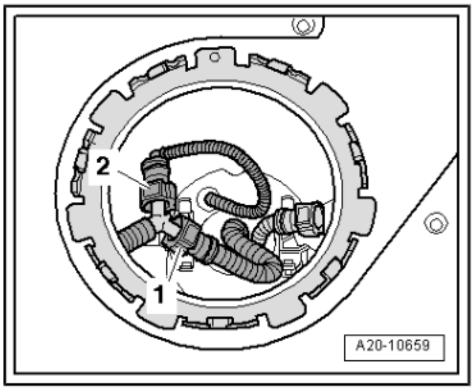
- Tightening torque ⇒ page 79
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



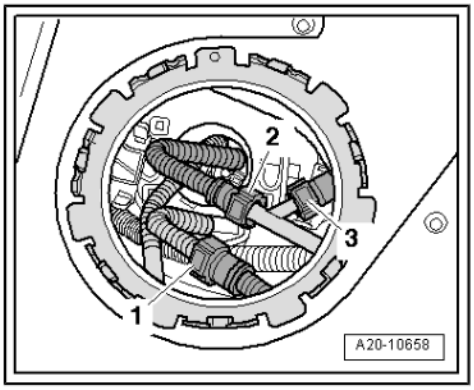
- Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).



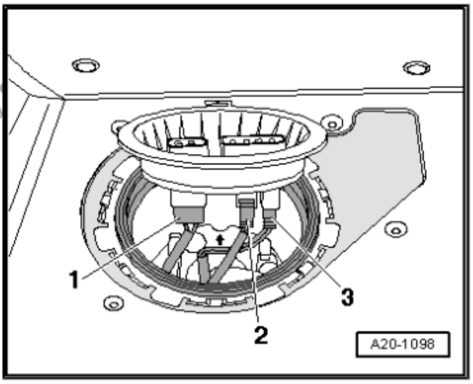
- Working through right fuel tank opening, fit supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side) so that they engage audibly.



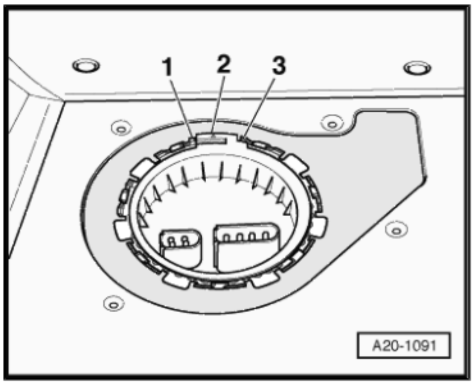
- Fit connecting pipe -1- through left opening on fuel tank so that it engages audibly.



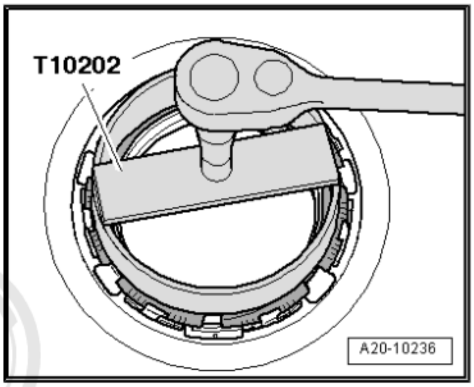
- Connect electrical connectors -1 ... 3- on underside of flange (left-side).
- Install new seal for flange (seal must be installed dry).



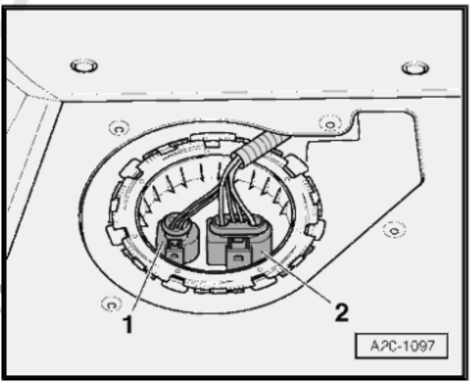
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



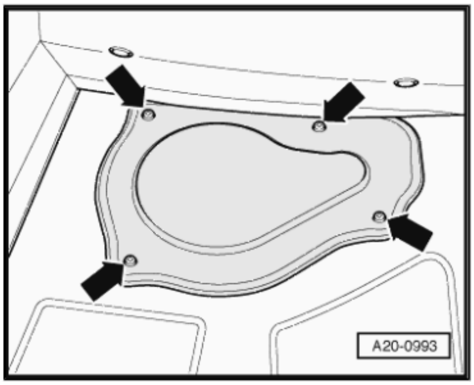
- Tighten locking ring.



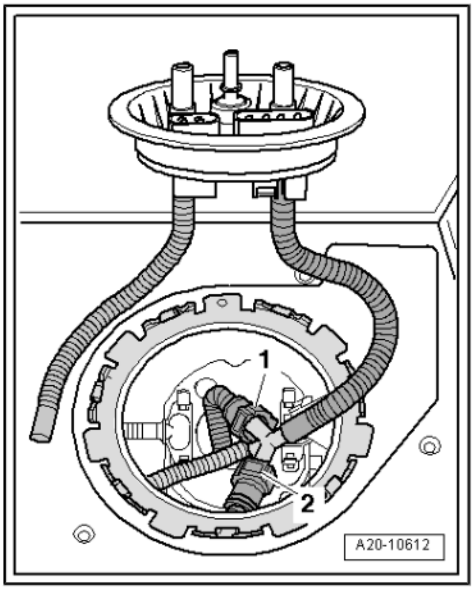
- Attach electrical connectors -1- and -2- on flange (left-side).



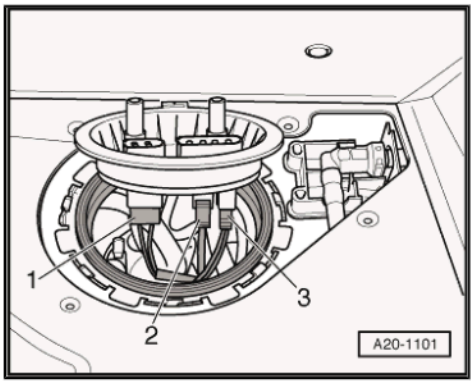
- Secure cover for flange (left-side) -arrows-.



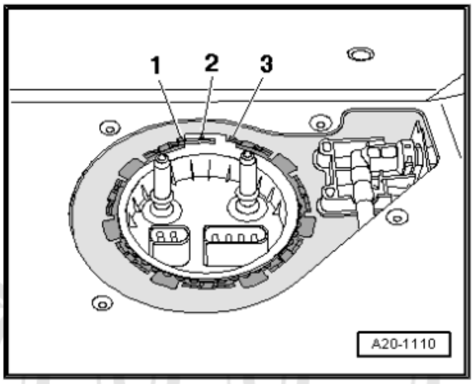
- Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



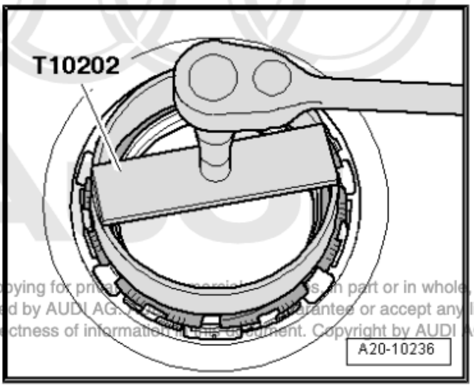
- Connect electrical connectors -1 ... 3- on underside of flange (right-side).
- Install new seal for flange (seal must be installed dry).



- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



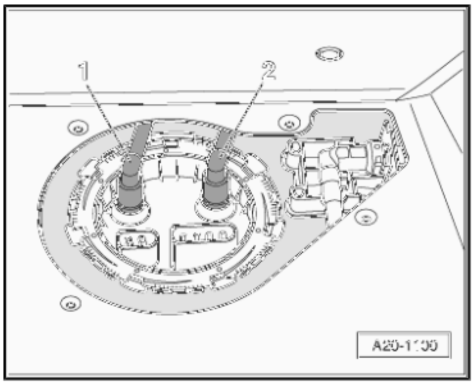
- Tighten locking ring.



- Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

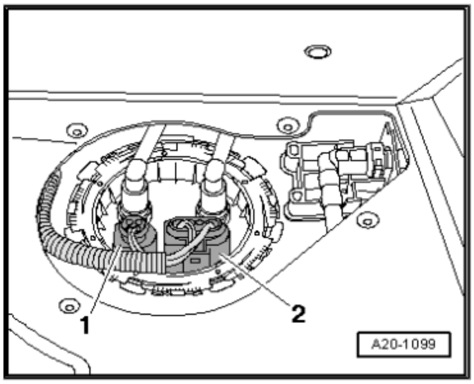
Vehicles with auxiliary heater:

- Also fit fuel supply line going to auxiliary heater so that it engages audibly.

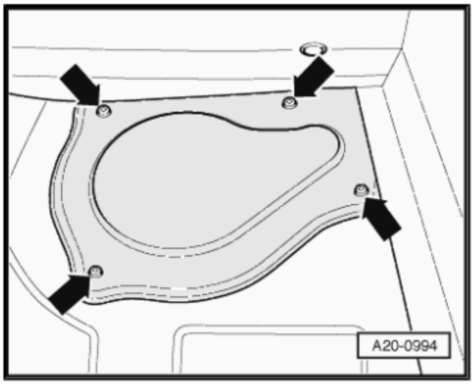


All vehicles (continued):

- Attach electrical connectors -1- and -2- on flange (right-side).



- Secure cover for flange (right-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing



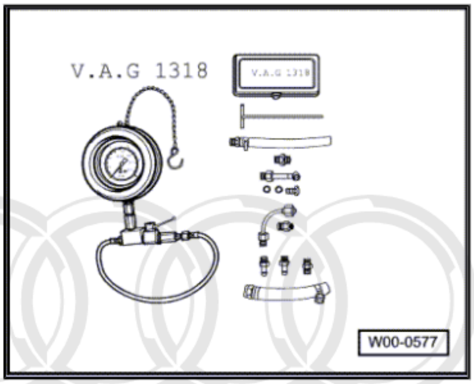
Vehicles with auxiliary heater:

- Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.

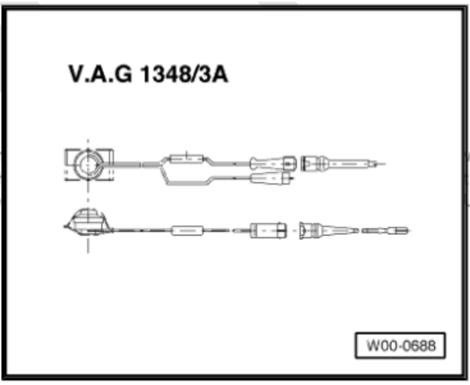
5.7 Checking delivery rate of fuel pumps - vehicles with 6-cylinder engine

Special tools and workshop equipment required

- ♦ K-Jetronic pressure tester - V.A.G 1318-



- ♦ Adapter set - V.A.G 1318/10-12-
- ♦ Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



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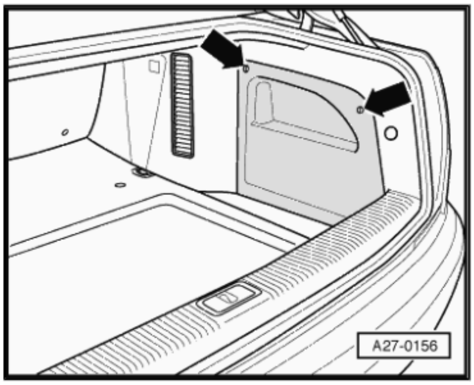
- ♦ Fuel-resistant measuring container

Procedure

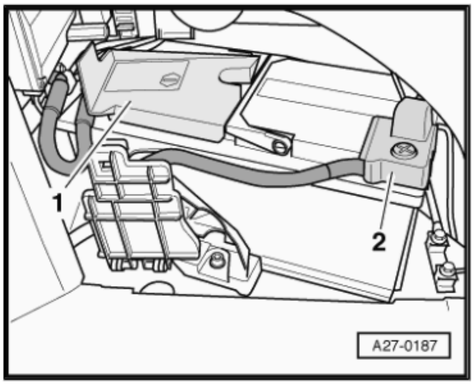
- Observe test conditions ⇒ page 3 .



WARNING

Observe safety precautions ⇒ page 1 .

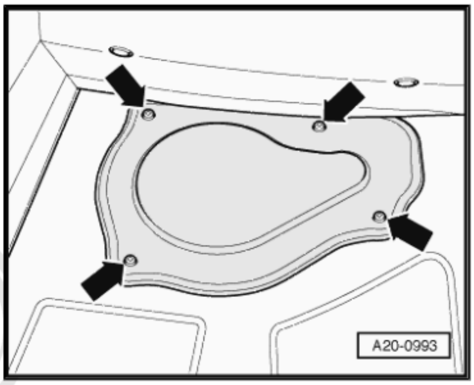
- Remove luggage compartment side trim cover (right-side) -arrows-.



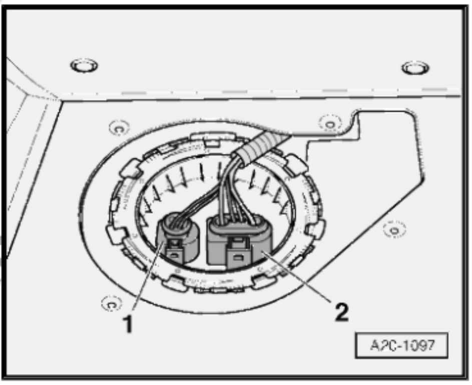
- Remove cover -2- over battery.

Note

Disregard -item 1-.



- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.

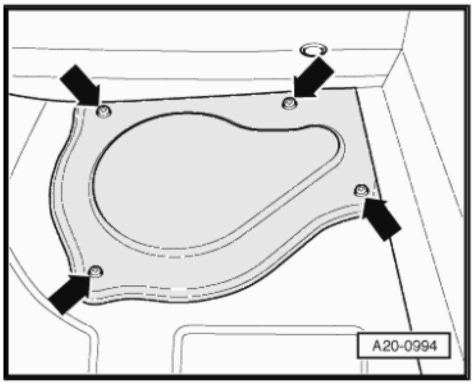


- Unplug electrical connector -2- on flange (left-side).

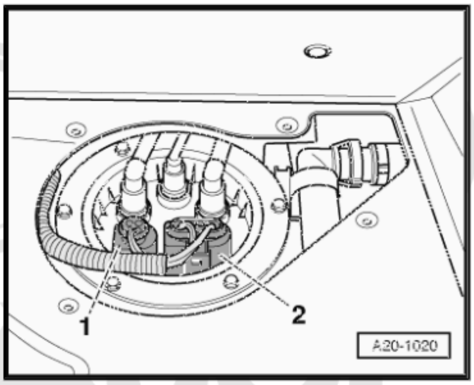
Note

Disregard -item 1-.

- Unscrew cover for flange (right-side) -arrows-.



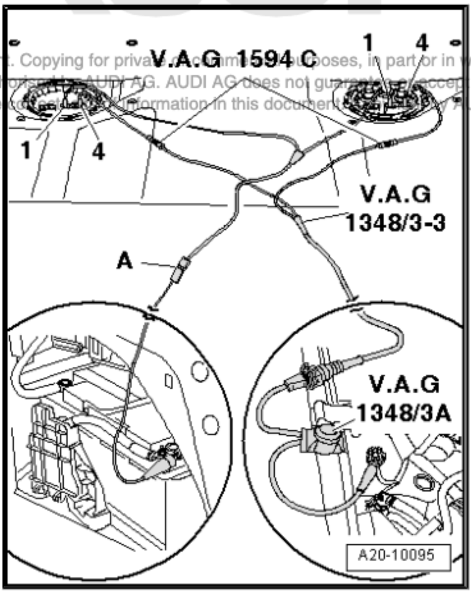
- Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C-.
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
- Connect crocodile clip to earth point in engine compartment.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.

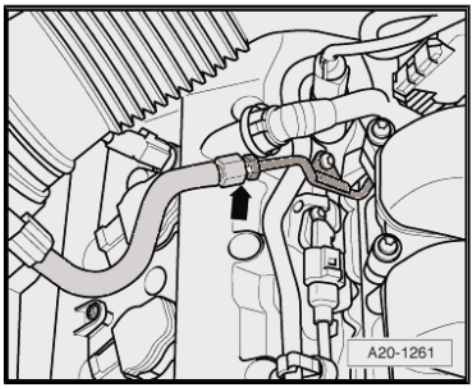


WARNING

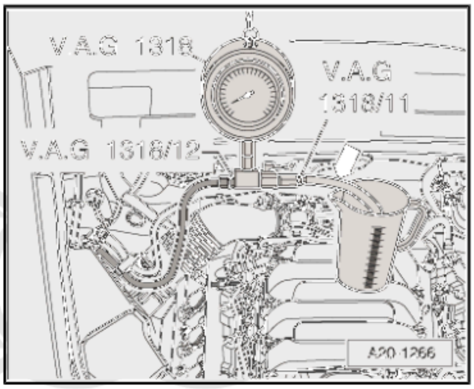
The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .

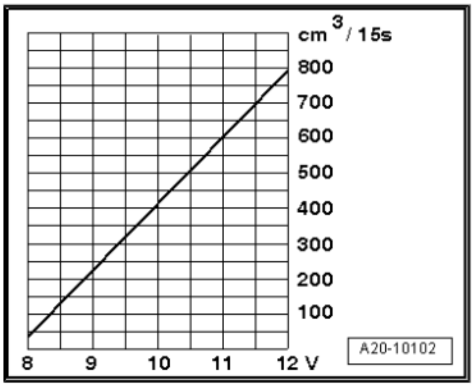


- – Disconnect fuel line -arrow-.



- – Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.
- – Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.
- – Open cut-off valve on pressure tester.
- • Lever points in direction of flow.
- – Build up pressure in fuel system by pressing the remote control and slowly closing the cut-off valve on the pressure tester.
- • Specification: 4 bar
- – From this point on do not move position of cut-off valve.
- – Empty the measuring container.

- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

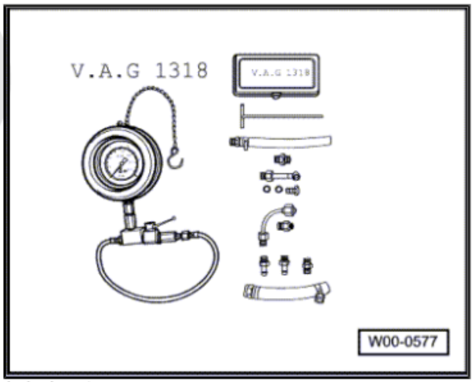
Installation is carried out in the reverse order; note the following:

- Secure fuel line to engine ⇒ Rep. gr. 24 .

5.8 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine

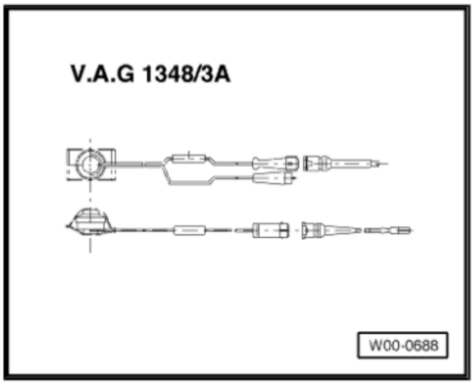
Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

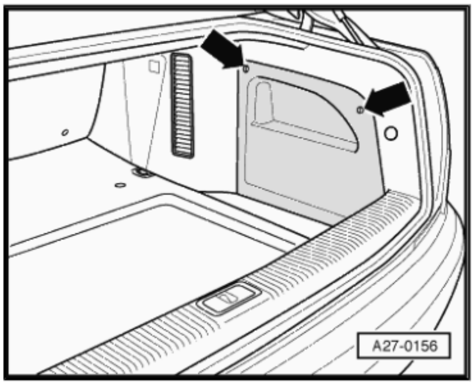
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

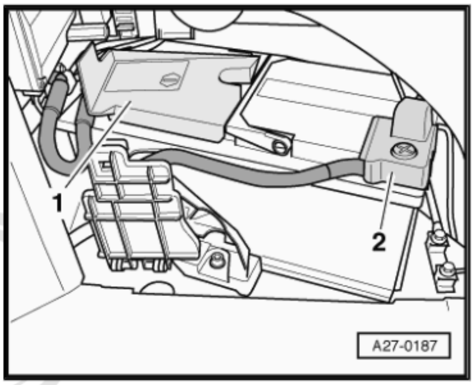
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

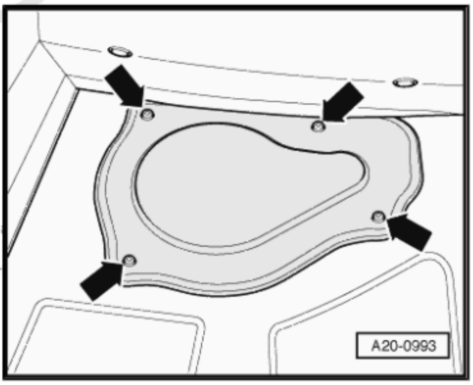
Note

Disregard -item 1-.

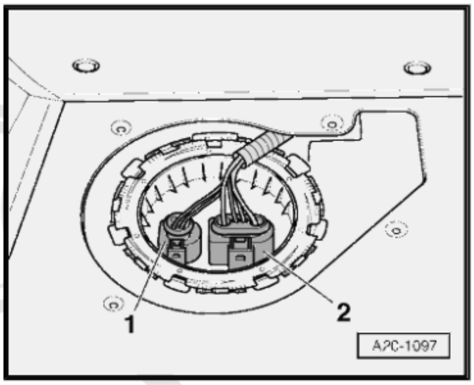


– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



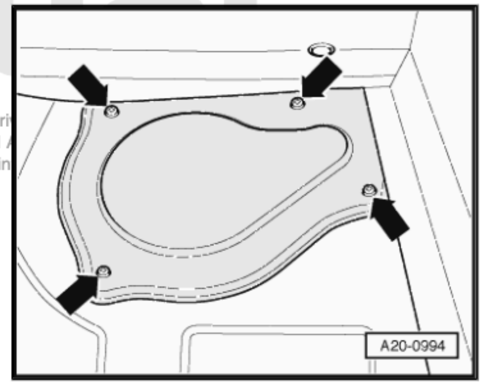
– Unplug electrical connector -2- on flange (left-side).



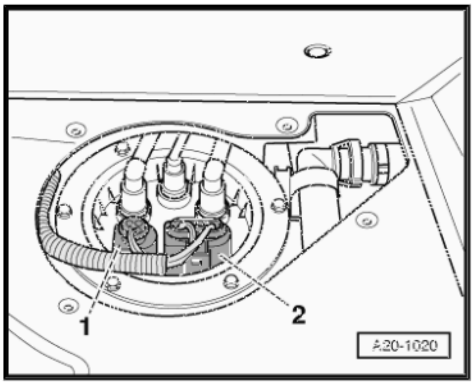
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

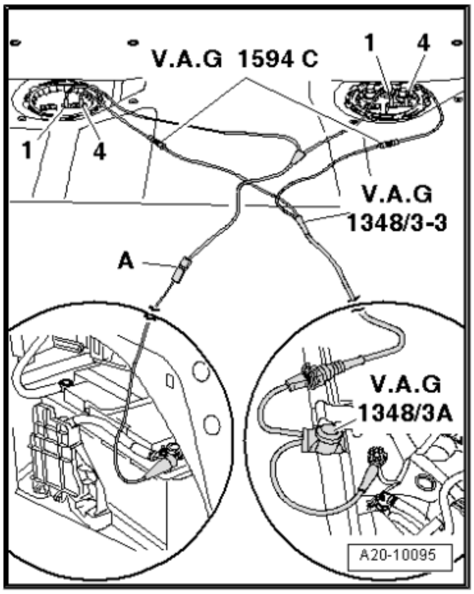
– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .

– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.

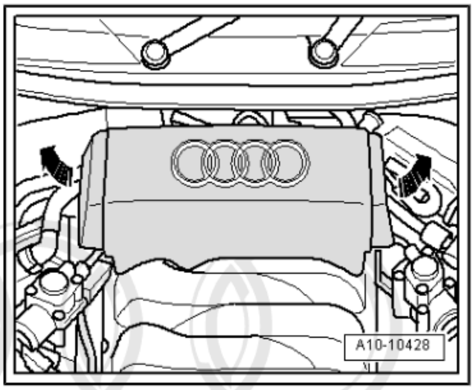
– Connect crocodile clip to earth point in engine compartment.

– Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.

– Remove filler cap from fuel filler neck.

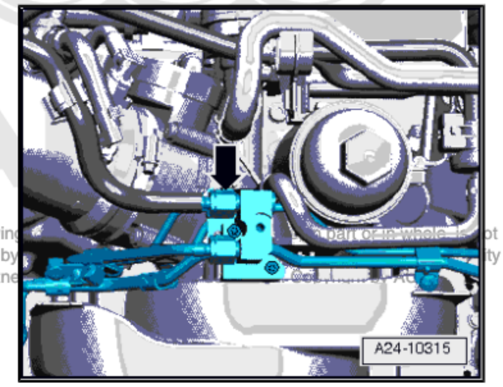


- Pull off engine cover panel (rear) -arrows-.



> **WARNING**
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*

- Disconnect fuel supply line -arrow- at connecting piece.



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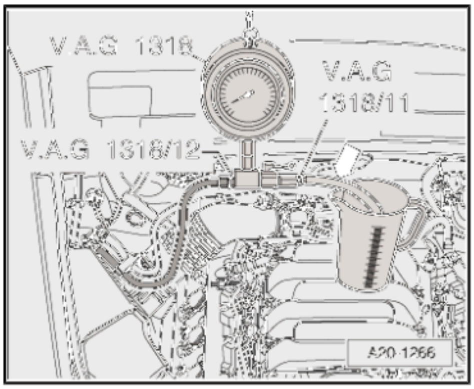
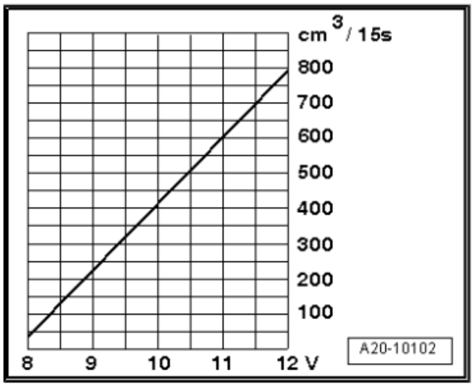
> **Caution**
>
> *Rules for cleanliness when working on the injection system ⇒ page 3 .*

- Disconnect fuel line -arrow-.

- Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.
- Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.
- Open cut-off valve on pressure tester. Lever must point in direction of flow.
- Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.
- Specification: 4 bar
- From this point on do not move position of cut-off valve.
- Empty the measuring container.



- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).

- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

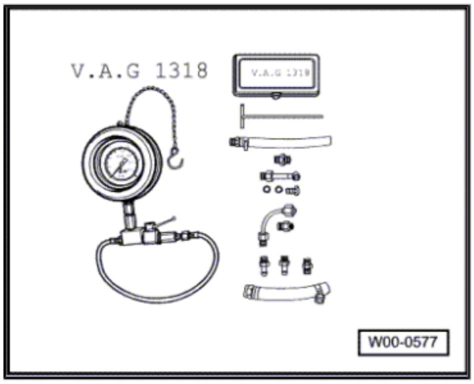
Installation is carried out in the reverse order; note the following:

- Secure fuel line to engine ⇒ Rep. gr. 24 .

5.9 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)

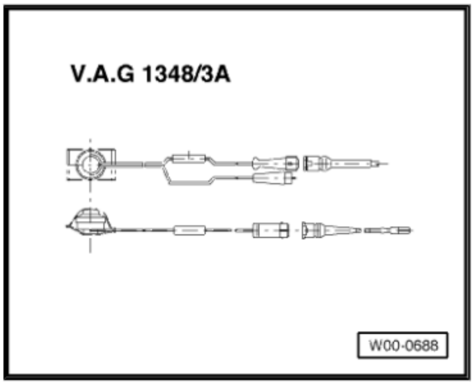
Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-

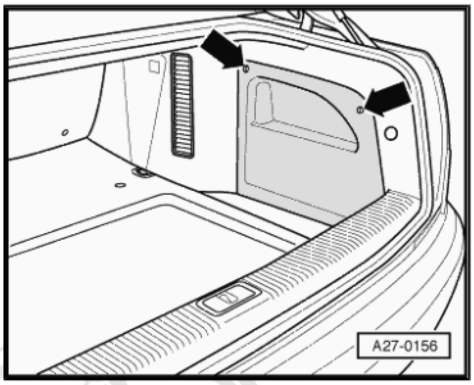


- Fuel-resistant measuring container

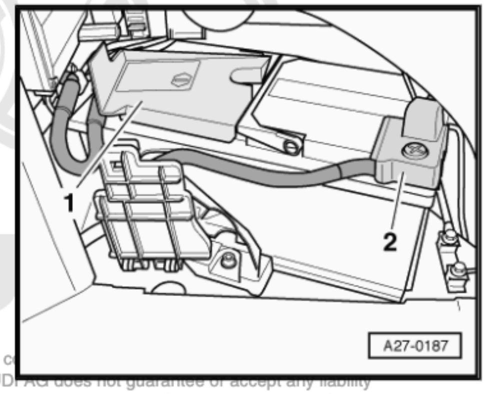
Procedure

– Observe test conditions ⇒ page 3 .

> **WARNING**
>
> *Observe safety precautions ⇒ page 1 .*



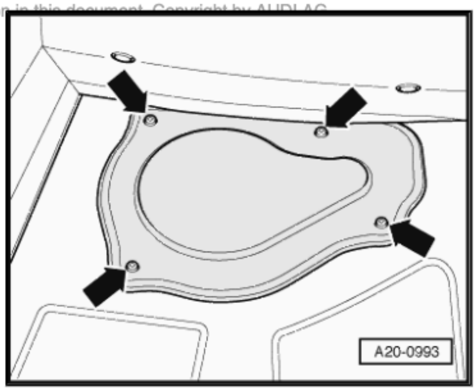
– Remove luggage compartment side trim cover (right-side) -arrows-.



– Remove cover -2- over battery.

Note

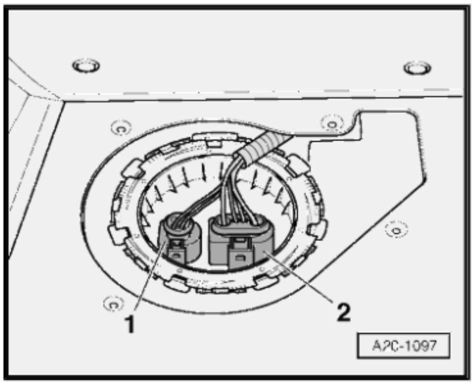
Disregard -item 1-.



– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.

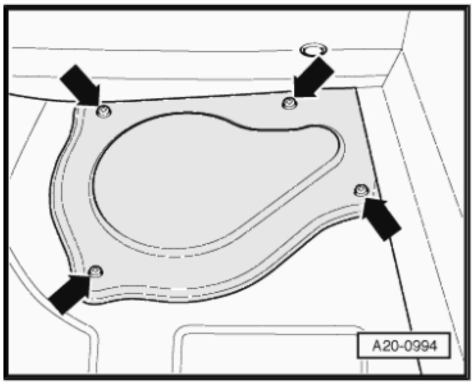
- Unplug electrical connector -2- on flange (left-side).



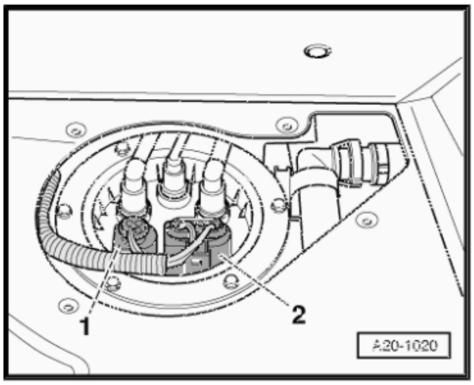
Note

Disregard -item 1-.

- Unscrew cover for flange (right-side) -arrows-.



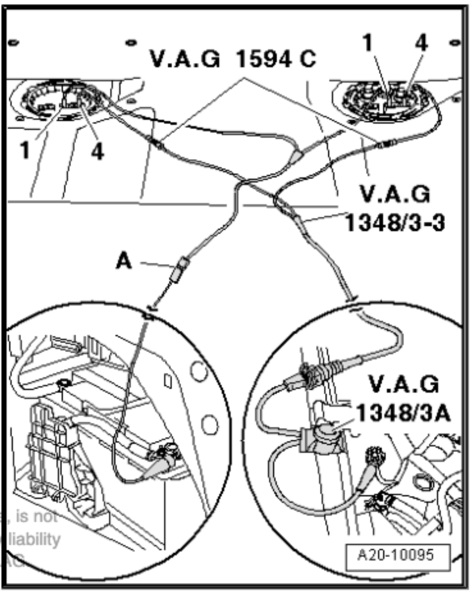
- Unplug electrical connector -2- on flange (right-side).



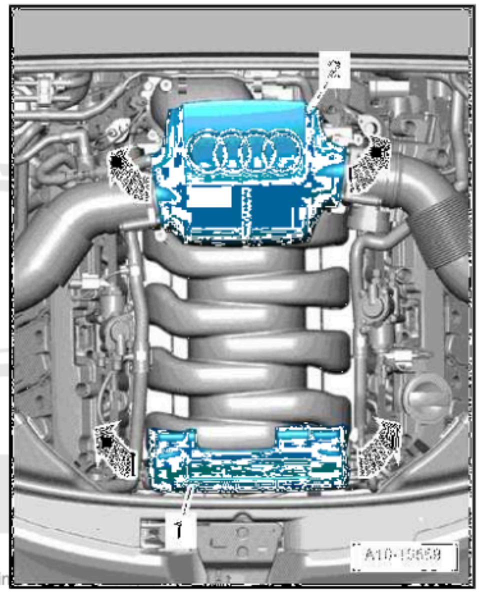
Note

Disregard -item 1-.

- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
- Connect crocodile clip to earth point in engine compartment.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.



– Pull off engine cover panel (rear) -2- -arrows-.



Note

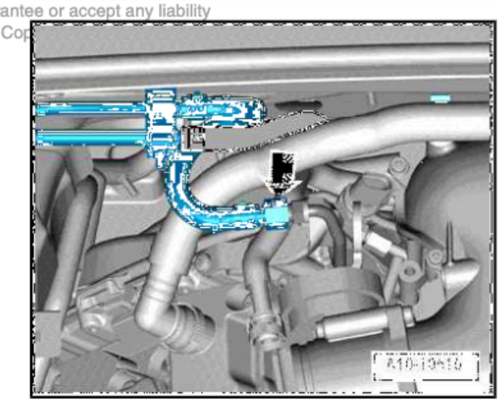
Disregard -item 1-.

WARNING

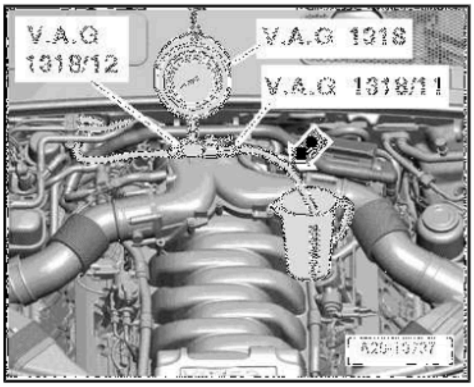
The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .



– Disconnect fuel pipe -arrow- at fuel rail.



– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester. Lever must point in direction of flow.

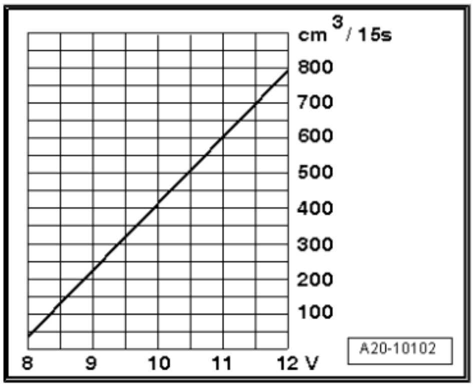
– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

- Specification: 4 bar

– From this point on do not move position of cut-off valve.

– Empty the measuring container.

- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm³/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

Installation is carried out in the reverse order; note the following:

- Secure fuel line to fuel rail ⇒ Rep. gr. 24 .

5.10 Fuel pump control unit - J538-

Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

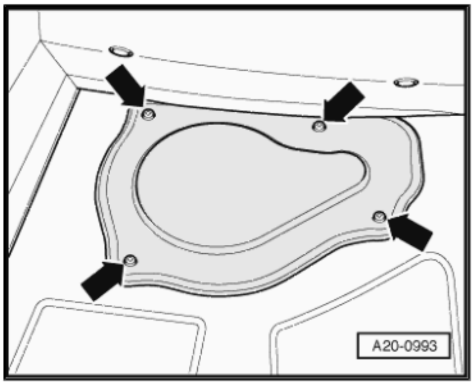
5.11 Removing and installing fuel pump control unit - J538-

Removing

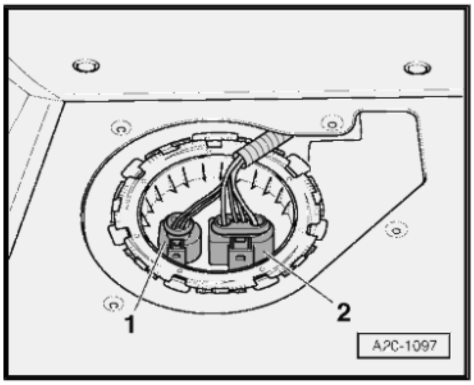
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

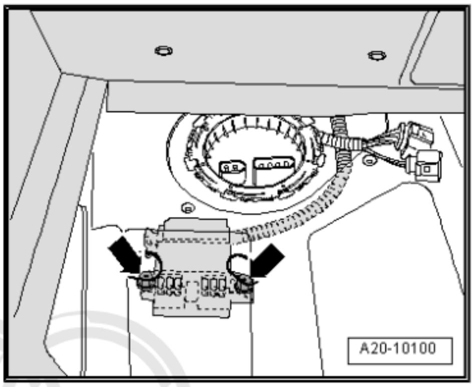
- Switch off ignition and remove ignition key.
- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (left-side).



- Remove plugs in luggage compartment floor and unscrew nuts -arrows-.
- Slightly lift floor panel in the area of flange by hand and remove fuel pump control unit - J538- between floor panel and fuel tank flange.
- Unplug electrical connector at control unit.



Installing

Install in reverse order.

Tightening torque

Component	Nm
Fuel pump control unit - J538- to fuel tank	1.6

5.12 Suction-jet pumps

1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel delivery unit (right-side)

5 - Suction-jet pump (right-side)

6 - Supply line for suction-jet pump

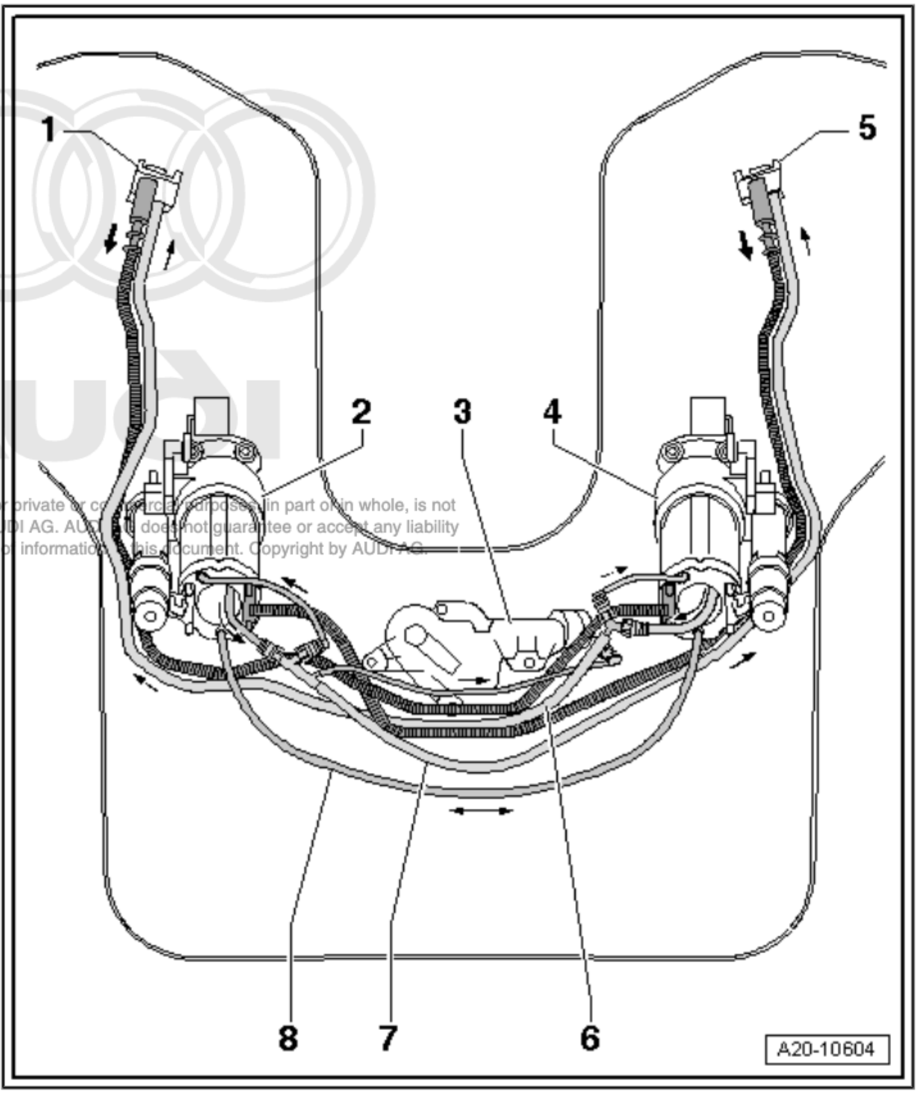
  - ☐ From fuel delivery unit (right-side) to suction-jet pump (left-side)

7 - Supply line for suction-jet pump

  - ☐ From fuel delivery unit (left-side) to suction-jet pump (right-side)

8 - Balance pipe

  - ☐ Between fuel delivery units



Description of operation
To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- ♦ For this reason, the fuel delivery units -item 2- and -item 4- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- ♦ Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- ♦ The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pumps -2- (left-side) and -4- (right-side) is fed via the supply lines -6- and -7- to the suction-jet pumps -1- and -5-, where it is passed through a nozzle and thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 5- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- ♦ In addition, the stream of fuel from the fuel pumps is supplied to the two smaller suction-jet pumps in the baffle housings via two Y-connectors. Working through the balance pipe -item 8-, these ensure that the baffle housings in both fuel delivery units are filled evenly.
- ♦ Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

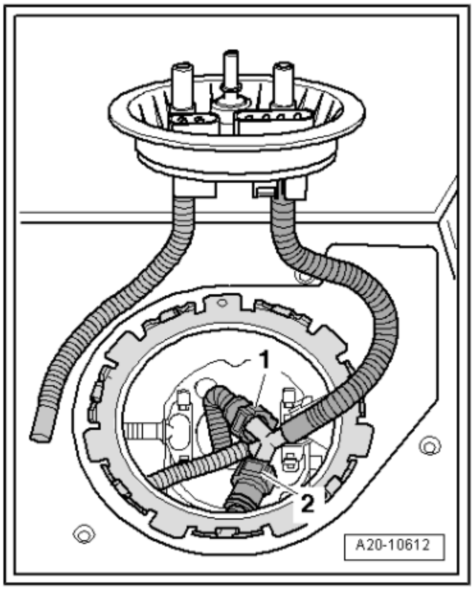
5.13 Removing and installing suction-jet pump (left-side)

Removing

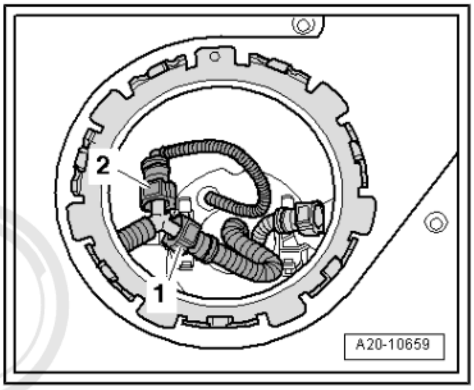
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

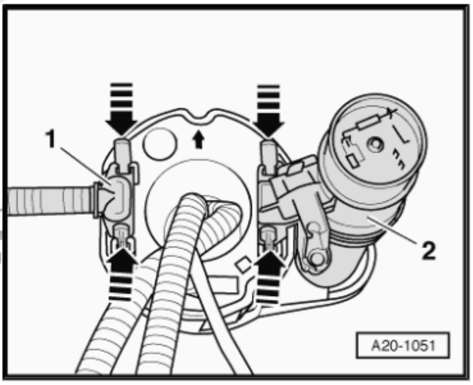
- Remove the fuel delivery unit (left-side) ⇒ page 26 .
- Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.
- Working through right fuel tank opening, press release tab and disconnect fuel supply line -1-.
- Detach flange.



- Working through right fuel tank opening, press release tabs and disconnect supply lines -1- and -2- for suction-jet pumps from Y-connector.



- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.

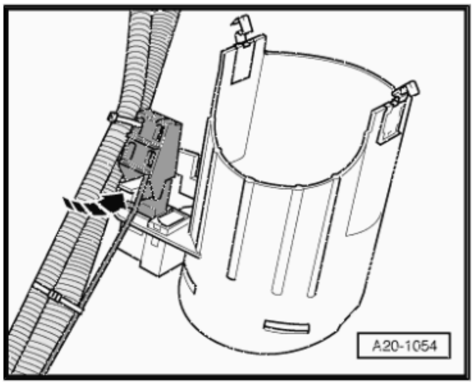


Note

Disregard -item 2-.

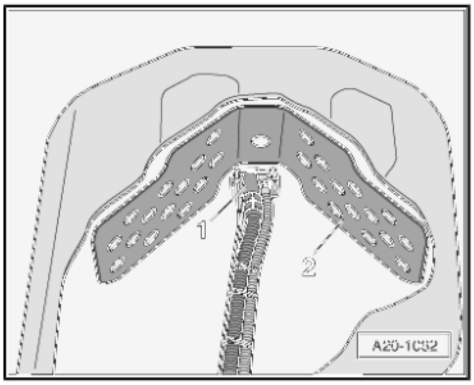
- Pull out disconnected fuel supply line through left fuel tank opening.

- Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



Installing

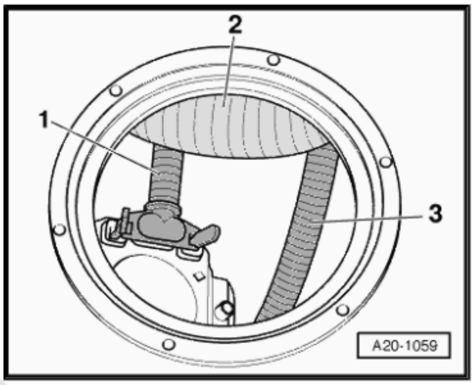
- Version with baffle plate: insert suction-jet pump (left-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.



- Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:
- The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

Note

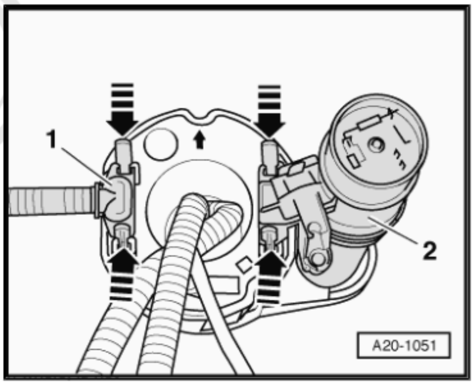
Disregard -item 1-.



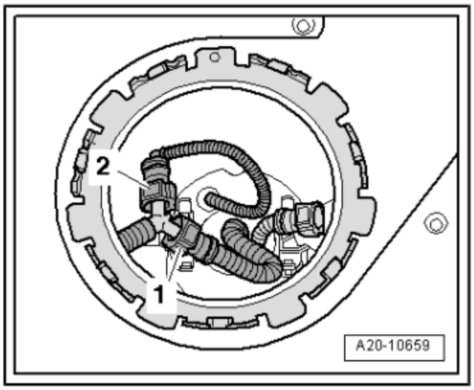
- Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

Note

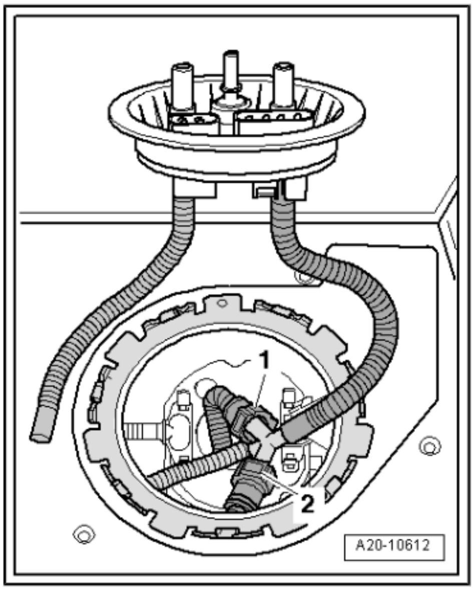
Disregard -item 2-.



- Working through right fuel tank opening, fit supply lines -1- and -2- for suction-jet pumps onto Y-connector so that they engage audibly.



- Working through right fuel tank opening, fit fuel supply line -1- so that it engages audibly.
- Insert fuel gauge sender 3 - G237- into fuel tank.
- Install fuel delivery unit (left-side) ⇒ page 31 .



5.14 Removing and installing suction-jet pump (right-side)

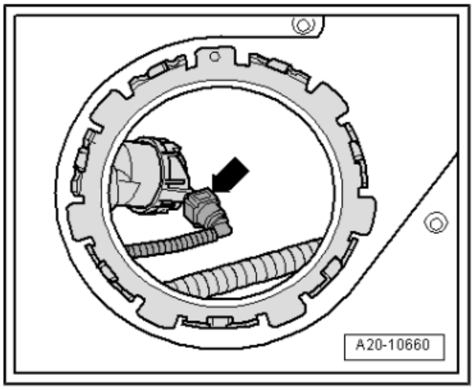
Removing

Observe safety precautions ⇒ page 1 .

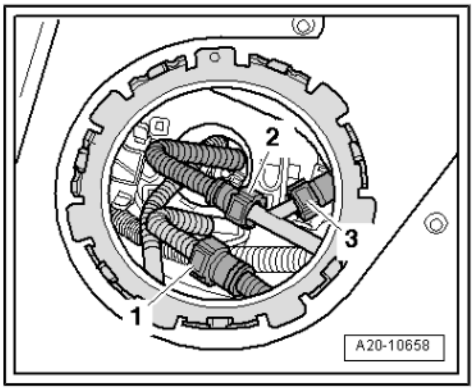
Observe rules for cleanliness ⇒ page 3 .

- Remove fuel delivery unit (right-side) ⇒ page 42 .
- Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

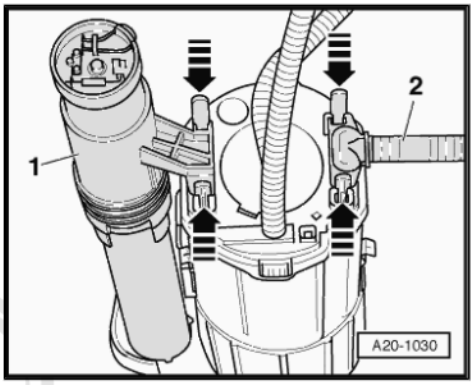
- Working through right fuel tank opening, press release tab and disconnect supply line for suction-jet pump -arrow- from expansion tank.



- Working through left fuel tank opening, press release tabs and disconnect supply lines -2- and -3- for suction-jet pumps from Y-connector.



- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.

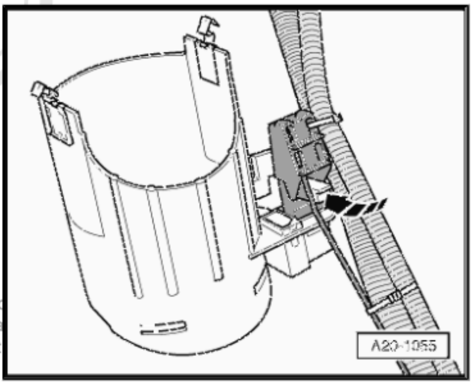


Note

Disregard -item 1-.

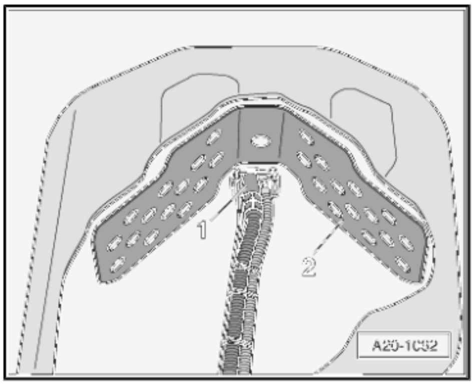
- Pull out disconnected fuel supply line through right fuel tank opening.

- Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.

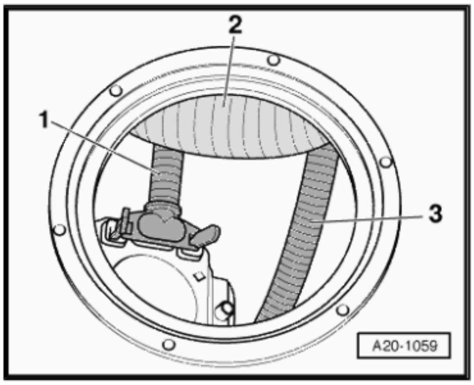


Installing

- Version with baffle plate: insert suction-jet pump (right-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.



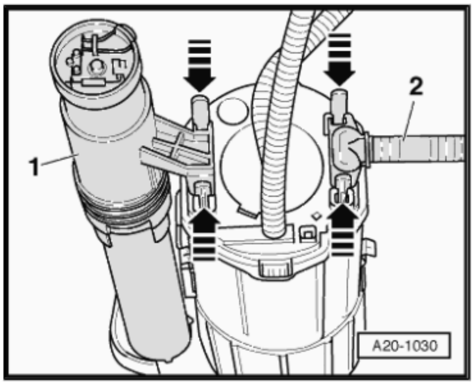
- Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:
- The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 3-.

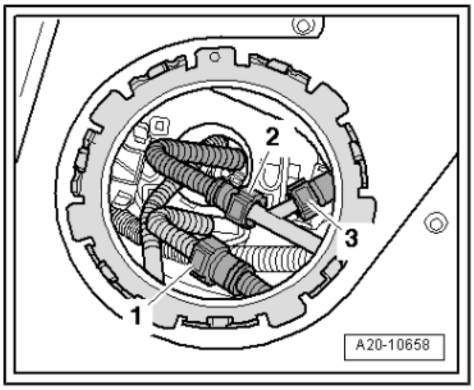
- Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.



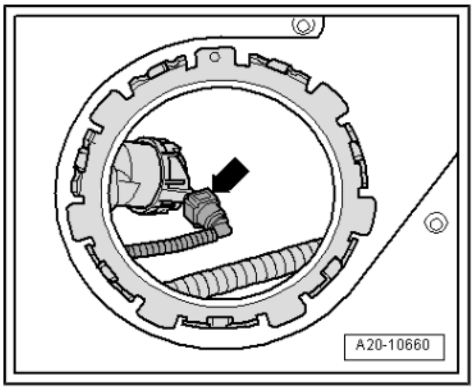
Note

Disregard -item 1-.

- Push supply line for suction-jet pump through right fuel tank opening into left fuel tank chamber.
- Working through left fuel tank opening, fit supply lines -2- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.



- Working through right fuel tank opening, fit supply line for suction-jet pump -arrow- onto connection on expansion tank so that it engages audibly.
- Insert fuel gauge sender 4 - G393- into fuel tank.
- Install fuel delivery unit (right-side) ⇒ page 48 .



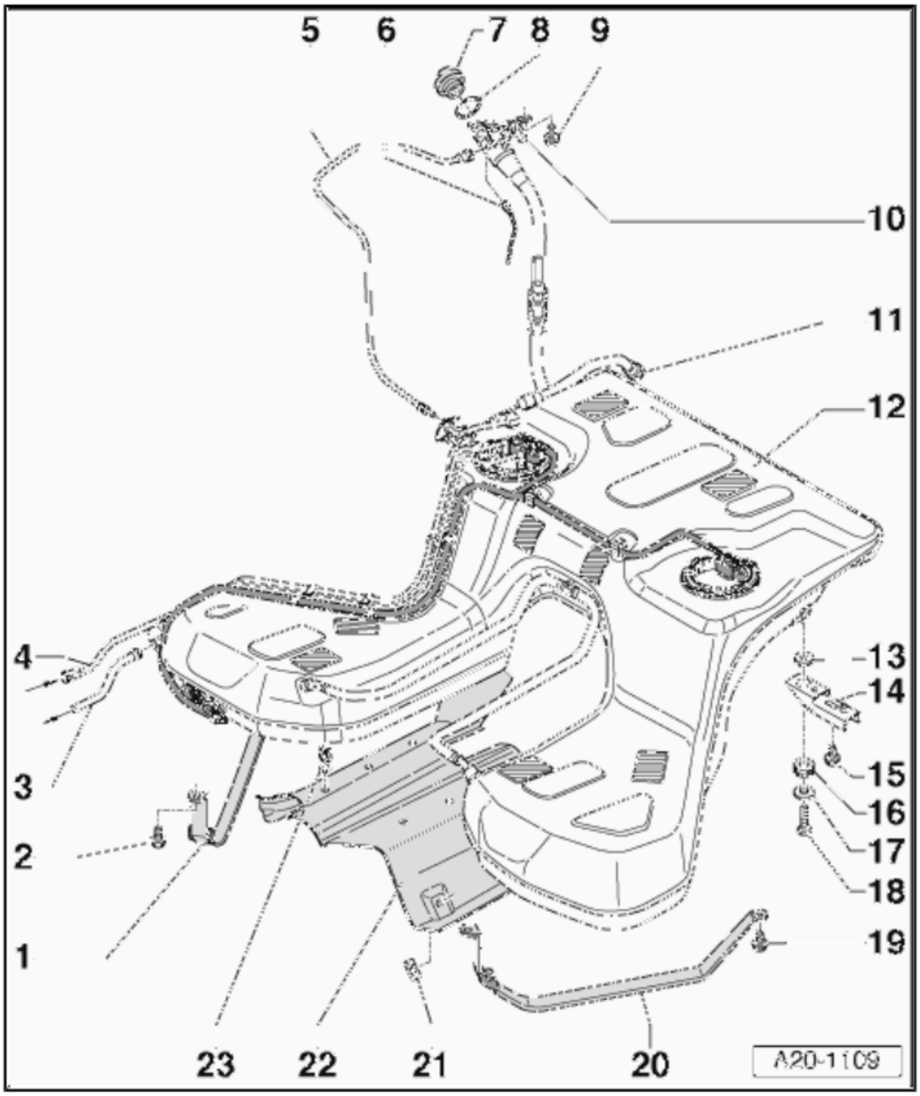
6 Fuel tank with attached components - all USA vehicles

⇒ “6.1 Fuel tank with attached components - exploded view”, page 110

⇒ “6.2 Draining fuel tank”, page 112

⇒ “6.3 Removing and installing fuel tank with attached components”, page 115

6.1 Fuel tank with attached components - exploded view



1 - Securing strap
- ☐ With spacer, installation position ⇒ page 111

2 - 22 Nm

3 - Fuel line
- ☐ From fuel filter
- ☐ To engine
- ☐ Press release tab on connection piece to disconnect

4 - Fuel return line
- ☐ From engine
- ☐ Press release tab on connection piece to disconnect
- ☐ Clip onto fuel tank

5 - Breather line

6 - Earth connection
- ☐ To eliminate electrostatic charge
- ☐ Installation position / test procedure ⇒ page 111
- ☐ Make sure that connector is securely fitted
- ☐ After installation, use an ohmmeter to check the electrical connection between the fuel filler neck and a bare metal part on the body. Specification: approx. 0 Ω

7 - Filler cap
- ☐ With solenoid for fuel tank cap switch - F314- ⇒ page 112

8 - Seal
- ☐ Renew if damaged

9 - 22 Nm

10 - Electrical connector
- ☐ For fuel tank cap switch - F314- ⇒ page 112

11 - Breather line
- ☐ To activated charcoal filter at bottom of spare wheel well on underbody

- ☐ Remains on fuel tank when tank is removed

12 - Fuel tank

- ☐ Removing and installing ⇒ page 115

13 - Bush

14 - Fuel tank bracket

15 - 22 Nm

16 - Rubber buffer

17 - Washer

18 - 22 Nm

19 - 22 Nm

20 - Securing strap

- ☐ With spacer, installation position ⇒ page 111

21 - Clip

- ☐ For heat shield

22 - Heat shield

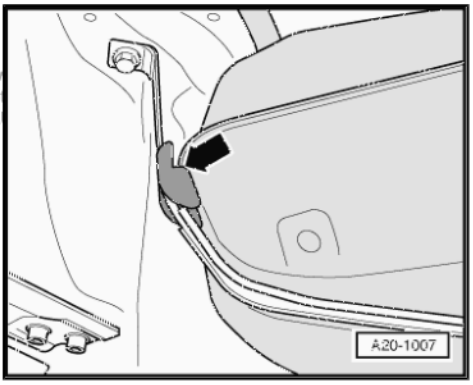
23 - Clip

- ☐ For heat shield

Audi

Installation position of spacers

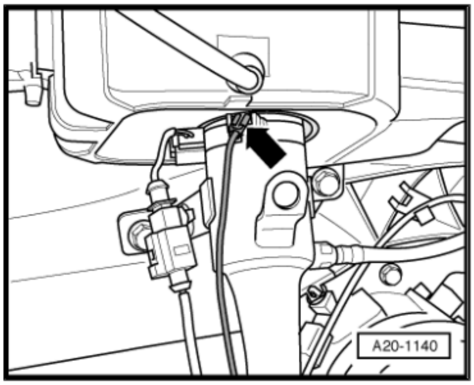
– Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.



Installation position of earth connection

– Route earth connection as shown in illustration.

– Ensure that connector for earth connection is securely fitted on metal ring on fuel filler neck -arrow-.



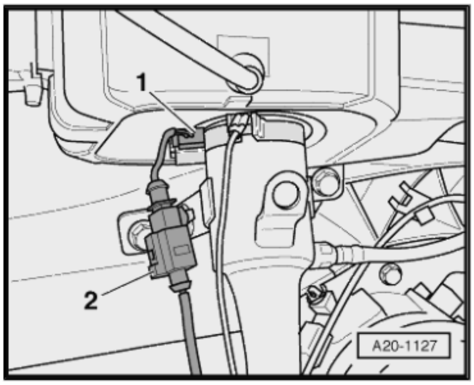
WARNING

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

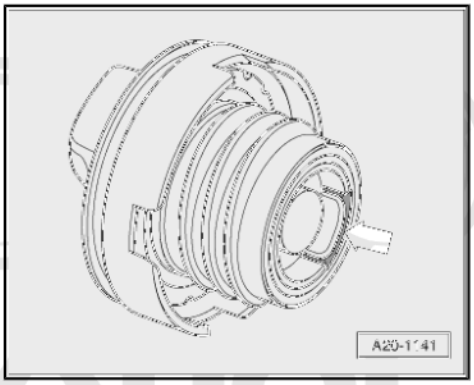
Fuel tank cap switch - F314-

– Ensure that electrical connector -2- for fuel tank cap switch - F314- -item 1- is firmly seated on fuel filler neck.



Filler cap with solenoid

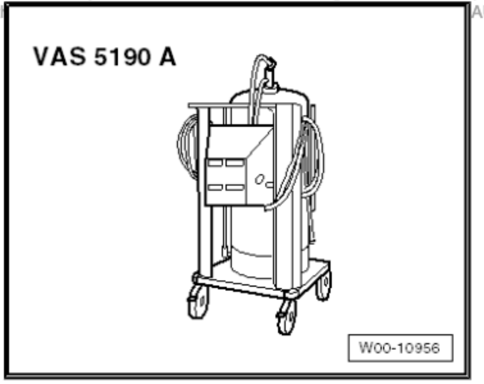
– Solenoid for fuel tank cap switch - F314- -arrow-.



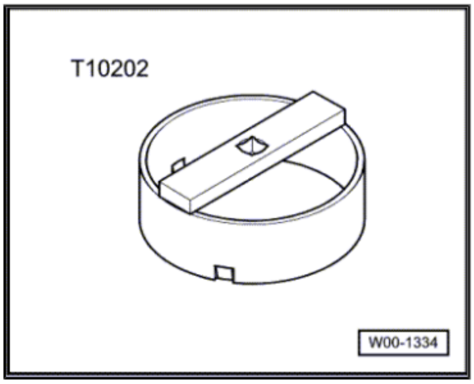
6.2 Draining fuel tank

Special tools and workshop equipment required

- ◆ Fuel extractor - VAS 5190A-



- ◆ Vehicles from approx. 11.2002: Wrench - T10202-



Procedure

Observe safety precautions ⇒ page 1 .

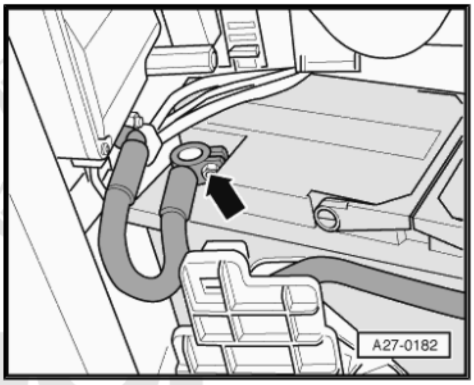
Observe rules for cleanliness ⇒ page 3 .

– Briefly open filler cap for fuel tank and close again.

Caution

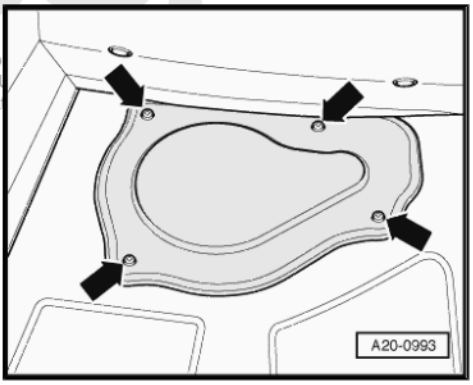
Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

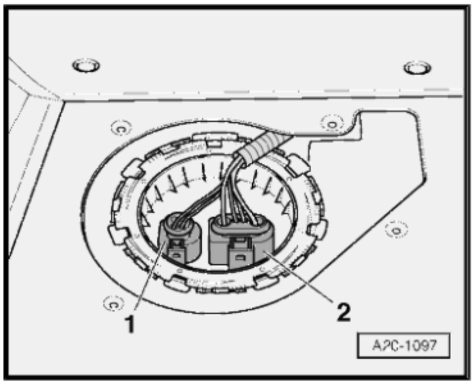


– Remove luggage compartment floor covering.

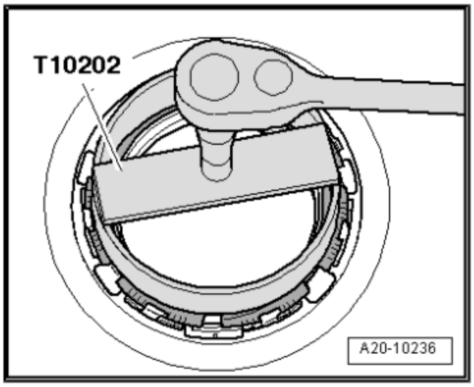
– Detach cover for flange (left-side) -arrows-.



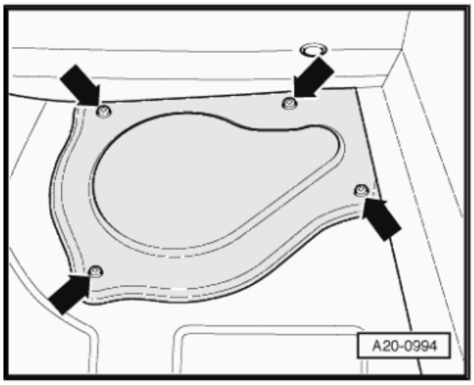
– Unplug electrical connectors -1- and -2- on flange (left-side).



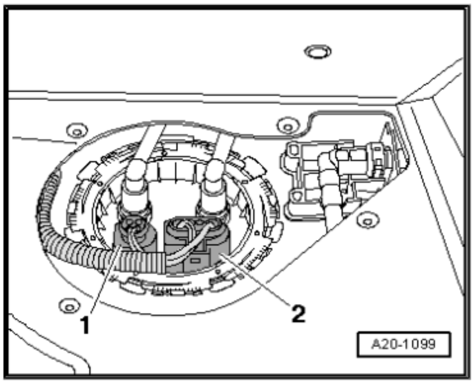
– Unscrew locking ring using wrench - T10202- .



– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connectors -1- and -2- on flange (right-side).

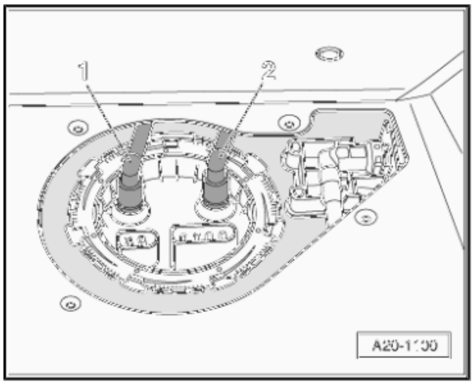


– Mark fuel return line -1- and fuel supply line -2-.

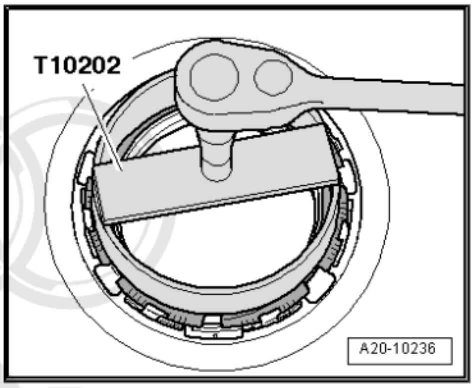
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

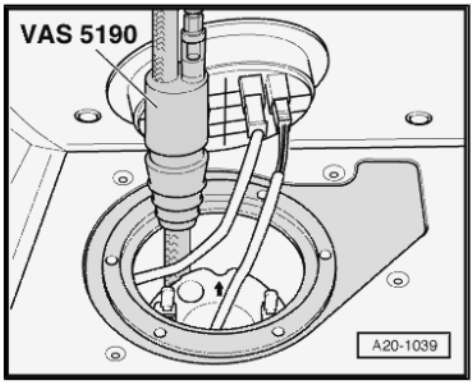
– Detach both lines from flange (press release tabs).



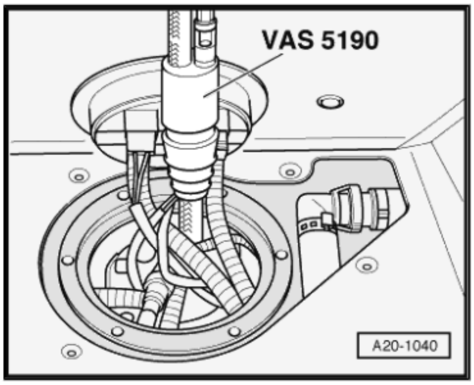
– Unscrew locking ring using wrench - T10202- .



- Connect earth wire of fuel extractor - VAS 5190A- to earth stud of energy management control unit - J644- .
- Remove flange (left-side) and lay it aside with electrical wires connected.
- Detach seal.
- Extract fuel from left fuel tank chamber through fuel tank opening using fuel extractor - VAS 5190A- .



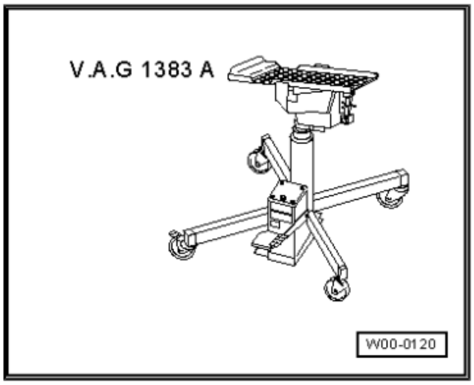
- Remove flange (right-side) and lay it aside with electrical wires and fuel lines connected.
- Detach seal.
- Extract fuel from right fuel tank chamber through fuel tank opening using fuel extractor unit - VAS 5190A- .
- Re-install flange: left-side ⇒ page 75 , right-side ⇒ page 86 .



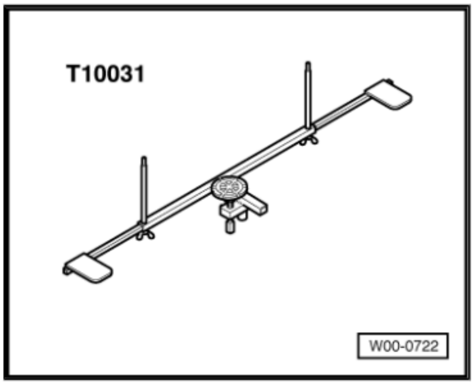
6.3 Removing and installing fuel tank with attached components

Special tools and workshop equipment required

- ◆ Engine and gearbox jack - V.A.G 1383 A-



- ◆ Support - T10031-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

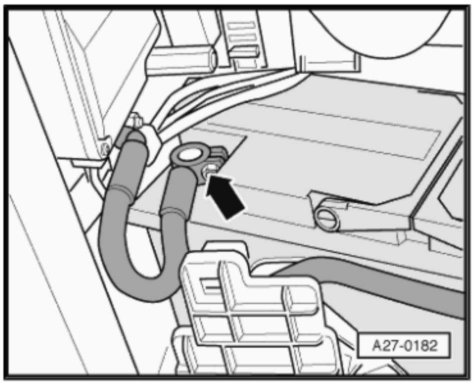
WARNING

- *To reduce weight, the fuel tank must be empty when it is removed from the vehicle. Drain the tank if necessary. Procedure ⇒ page 112*

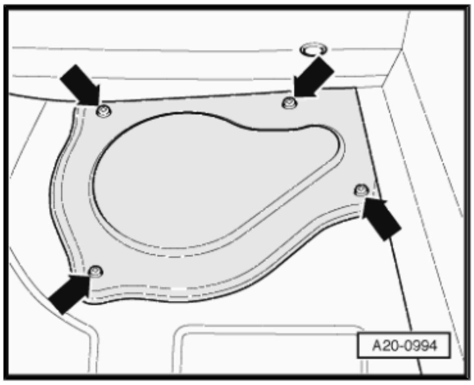
– Release the tank flap.

Caution

Observe notes on procedure for disconnecting the battery.

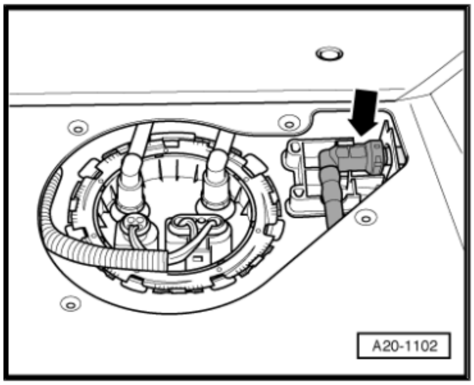


– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



– Press release tabs to disconnect breather pipe -arrow-.

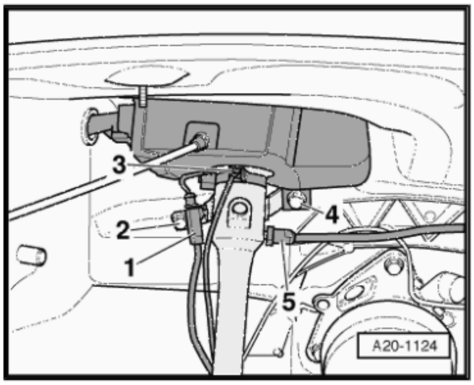
WARNING

BEFORE loosening the subframe bolts, ensure that the vehicle cannot tip forwards (for instance by putting a weight of about 50 kg in the luggage compartment).

– Remove rear axle ⇒ Rep. gr. 42 .

– Remove rear right wheel housing liner ⇒ Rep. gr. 66 .

- Disconnect earth wire -3- from fuel filler neck.
- Unplug electrical connector -1- for fuel tank cap switch -F314- .
- Disconnect breather pipe -5- from fuel filler neck.
- Remove bolts -2- and -4- for fuel filler neck.



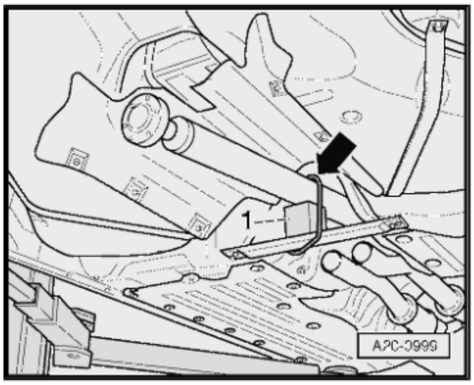
- Check that propshaft is secured to prevent it falling.

• The propshaft should be placed on a block of wood -1- and secured with wire or a cable tie -arrow-.

• The propshaft should be inclined slightly downwards to ensure there is sufficient space when installing the fuel tank.

Note

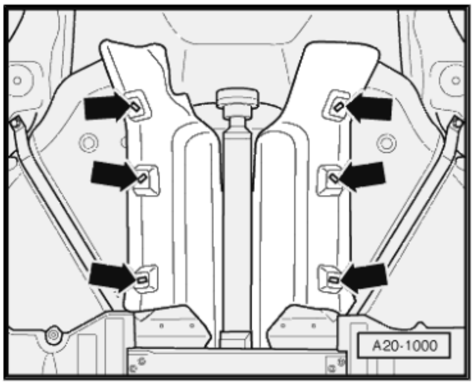
The propshaft must not be bent more than 8°.



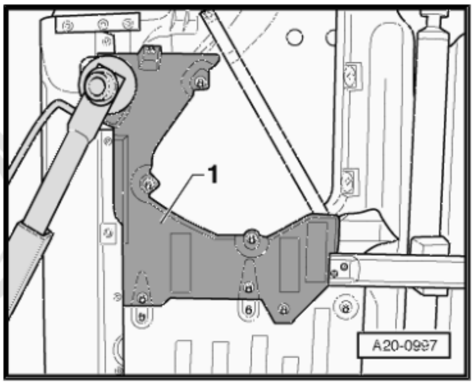
- Remove heat shield for propshaft -arrows-.

Note

The heat shield is also clipped in at the top of the breather pipe.



- Remove cover -1- from underside of vehicle (left-side).



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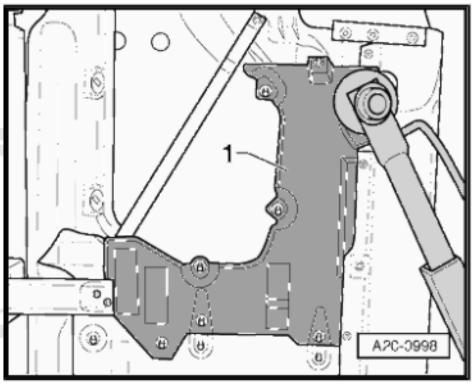
- Remove cover -1- from underside of vehicle (right-side).



- Unplug electrical connectors:

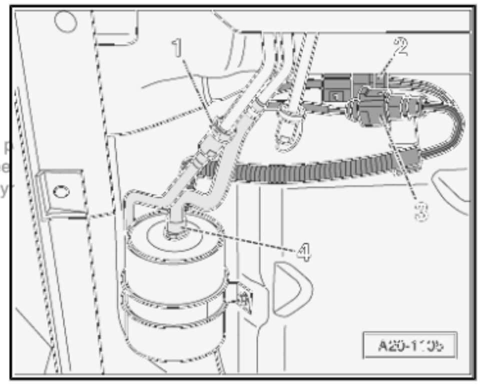
2 - To fuel pumps

3 - To fuel gauge senders

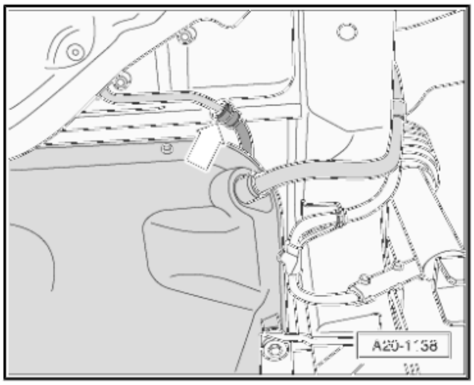
- Disconnect fuel pipes (press release tabs):

1 - Fuel return line

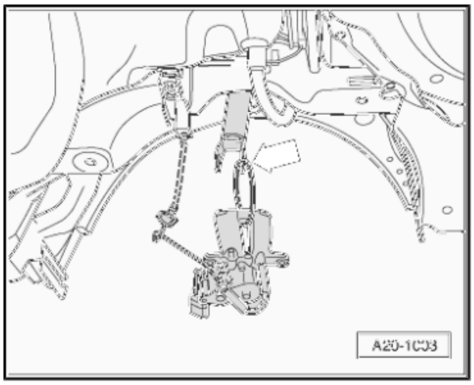
4 - Fuel supply line



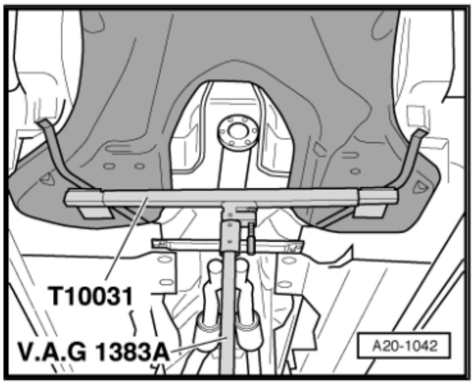
- Disconnect breather pipe -arrow- at rear right of fuel tank (press release tab).



- Attach brake calipers to suspension struts with wire -arrow- (brake calipers were fastened to fuel tank brackets upon removal of rear suspension).

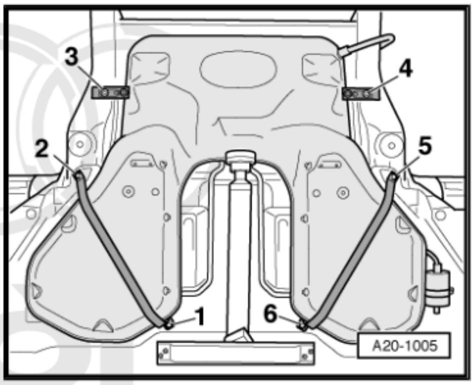


- Position engine and gearbox jack - V.A.G 1383 A- with support - T10031- under vehicle to support tank (do not use threaded rods of support).
- Support fuel tank using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
- In addition, a 2nd mechanic will be required to support the fuel tank at the rear by hand.



WARNING

To reduce weight, fuel tank must be empty upon removal.



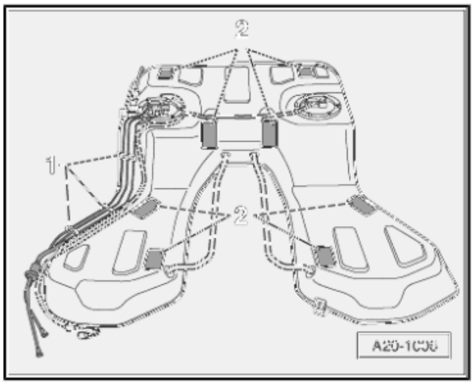
- Unscrew bolts -1 ... 6-; swivel fuel tank brackets forward if necessary.
- First lower fuel tank slightly at the rear so the fuel filler neck can be guided out of the body.
- Then lower fuel tank using engine and gearbox jack - V.A.G 1383 A- , simultaneously guiding fuel tank down by hand.

Note

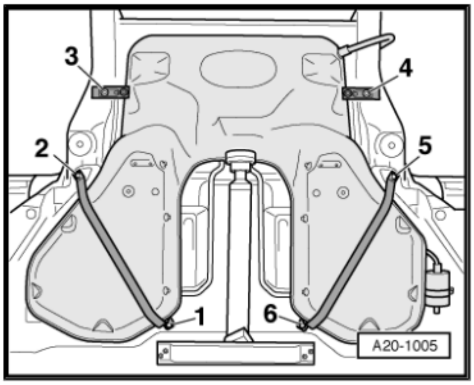
For illustration purposes the fuel tank is shown without engine and gearbox jack.

Installing

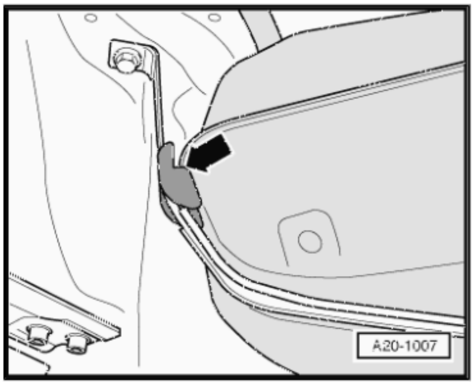
- Tightening torques ⇒ page 110
- Check that fuel pipes and wiring harnesses for fuel pumps and fuel gauge senders are clipped into brackets -1- on fuel tank.
- Bond pads -2- to fuel tank as shown when installing new fuel tank.
- Position fuel tank with securing straps and brackets on underbody, using engine and gearbox jack - V.A.G 1383 A- and support - T10031- .
- When installing fuel tank, make sure that the fuel filler neck is correctly inserted into the opening on the body.

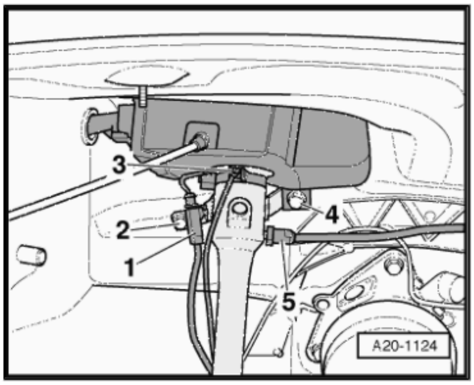


- Secure fuel tank by first tightening bolts at points -1-, -2-, -5- and -6-, then at points -3- and -4-.



- Make sure that securing strap spacers are located directly under seam of fuel tank -arrow-.





- Secure fuel filler neck using bolts -2- and -4-.
- Fit breather pipe -5- so that it engages audibly.
- Connect electrical connector -1- for fuel tank cap switch -F314-
- Check the earth wiring -3- and connector tab for traces of oxidation. Remove any traces of oxidation if necessary.

WARNING

After installation, use an ohmmeter to check the electrical connection between the metal ring on the fuel filler neck and a bare metal part on the body:

- *Specification: approx. 0 Ω.*

Remaining installation steps are carried out in reverse sequence; note the following:

Note

- *Always renew seals and gaskets when assembling.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

- Install rear axle ⇒ Rep. gr. 42 .
- Install rear right wheel housing liner ⇒ Rep. gr. 66 .
- Install rear section of exhaust system ⇒ Rep. gr. 26 .
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

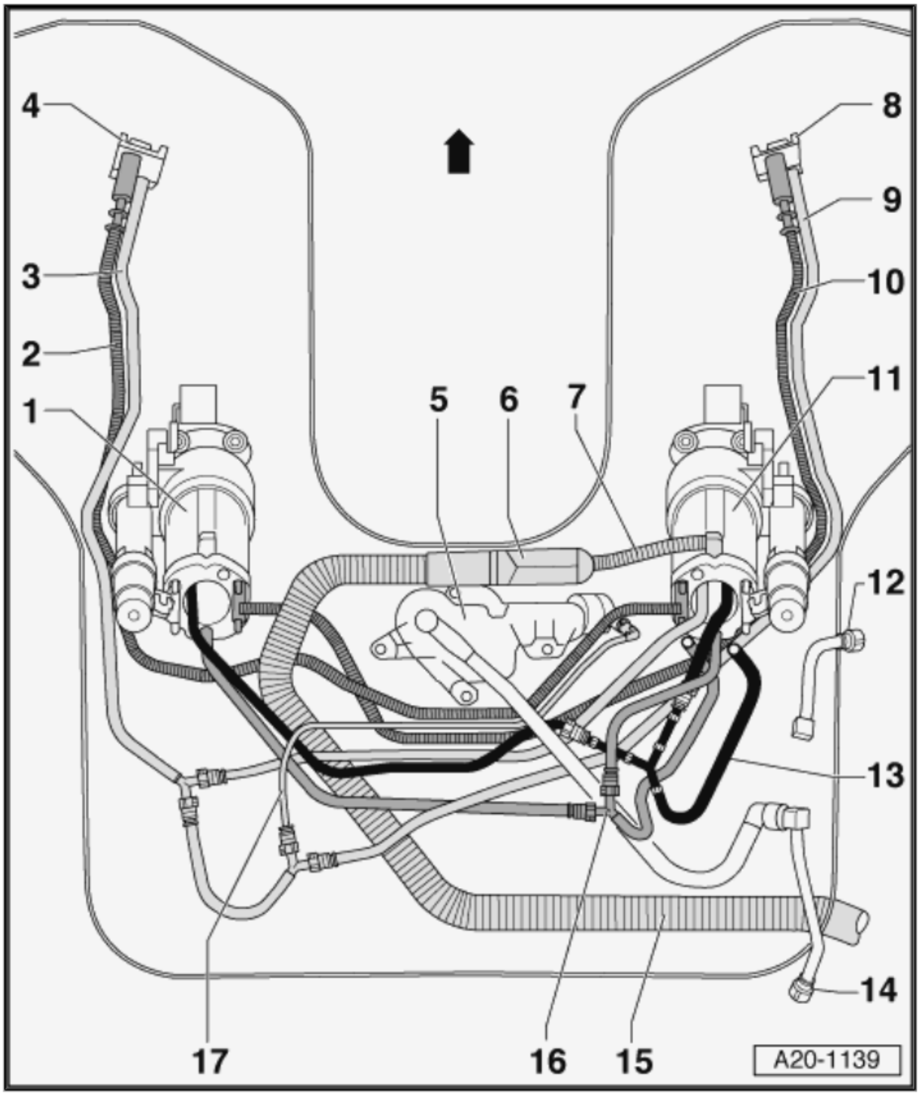
7 Routing of pipes/hoses (inside fuel tank) - USA vehicles with MPI engine

⇒ “7.1 Routing of pipes/hoses (inside fuel tank) - exploded view”, page 121

7.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 122 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line
  - ❑ From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump
  - ❑ From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Expansion tank
  - ❑ With suction-jet pump to extract fuel from expansion tank

6 - Non-return flap
  - ❑ For fuel filler pipe

7 - Primary filler pipe
  - ❑ To fuel delivery unit (right-side).
  - ❑ Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

8 - Suction-jet pump (right-side)

9 - Supply line for suction-jet pump
  - ❑ From fuel pump (right-side) to suction-jet pump (right-side)

10 - Fuel supply line
  - ❑ From suction-jet pump (right-side) to fuel delivery unit (left-side)

11 - Fuel delivery unit (right-side) with fuel pump - G23-

12 - Breather line

- ☐ To breather connection at top of fuel filler neck

13 - Fuel supply line

- ☐ From fuel pumps (left and right) to flange

14 - Breather line

- ☐ To activated charcoal filter at bottom of spare wheel well on underbody

15 - Fuel filler pipe

- ☐ From fuel filler neck to non-return flap in fuel tank

16 - Fuel return line

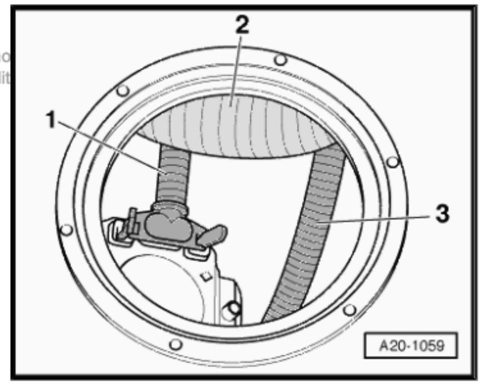
- ☐ From flange to fuel delivery units (left and right)

17 - Supply line for suction-jet pump

- ☐ To suction-jet pump in expansion tank

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



8 Fuel delivery unit with fuel pump and fuel gauge senders - USA vehicles with MPI engine

⇒ “8.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 123

⇒ “8.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 125

⇒ “8.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 129

⇒ “8.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 136

⇒ “8.5 Checking fuel pump G23 (right-side) - electrical test”, page 138

⇒ “8.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 141

⇒ “8.7 Checking delivery rate of fuel pumps - vehicles with fuel return line”, page 149

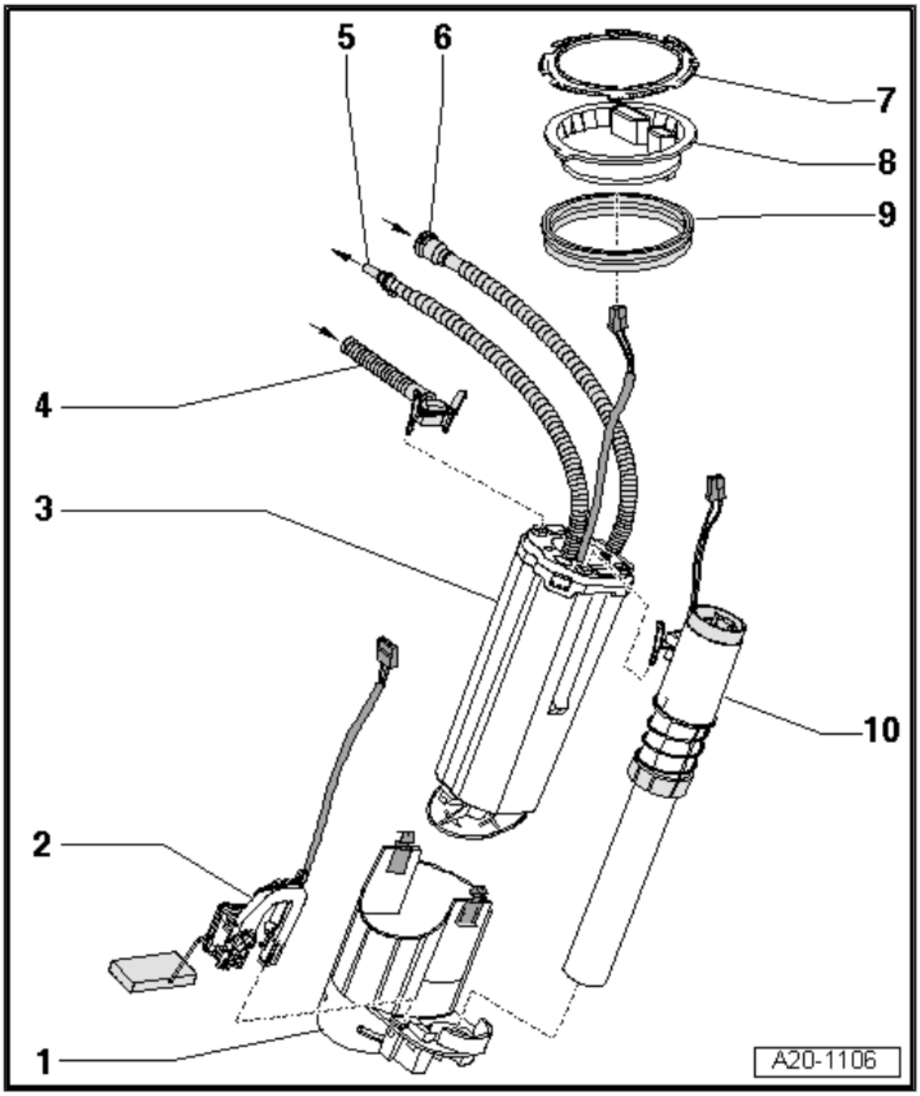
⇒ “8.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line”, page 153

⇒ “8.9 Suction-jet pumps”, page 157

⇒ “8.10 Removing and installing suction-jet pump (left-side)”, page 159

⇒ “8.11 Removing and installing suction-jet pump (right-side)”, page 160

8.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders -G- and -G237-



1 - Retainer
- ☐ For fuel delivery unit

2 - Fuel gauge sender - G-
- ☐ Black
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 221
- ☐ Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)
- ☐ With fuel system pressurisation pump - G6-
- ☐ Clipped onto retainer -item 1-
- ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ☐ Checking fuel pump (electrical test) ⇒ page 125
- ☐ Checking residual pressure ⇒ Rep. gr. 24
- ☐ Removing and installing ⇒ page 129
- ☐ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line
- ☐ From suction jet pump (right-side)
- ☐ Clipped onto fuel delivery unit -item 3-

5 - Fuel supply line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

6 - Fuel return line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

7 - Locking ring
- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

8 - Flange (left-side)
- ☐ Installation position ⇒ page 125

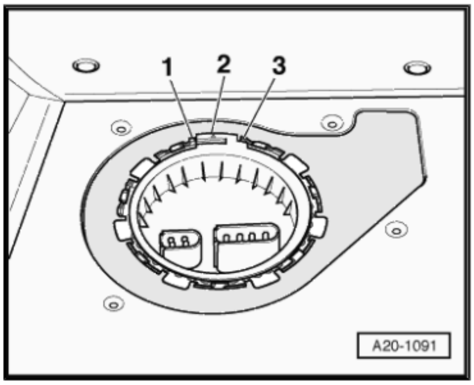
9 - Seal
- ☐ Renew
- ☐ Install dry

10 - Fuel gauge sender 3 - G237-
- ☐ Grey
- ☐ Clipped onto fuel delivery unit -item 3-
- ☐ Checking resistance values ⇒ page 225

☐ Removing and installing ⇒ page 226

Installation position of flange (left-side)

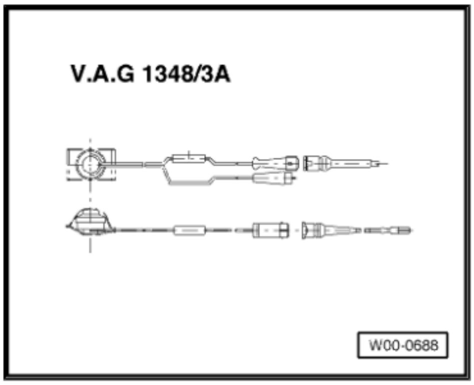
- Install new seal for flange (seal must be installed dry).
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



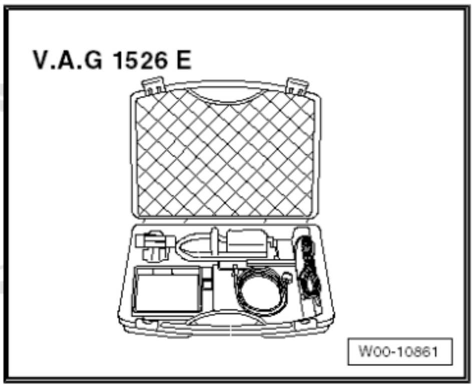
8.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

Special tools and workshop equipment required

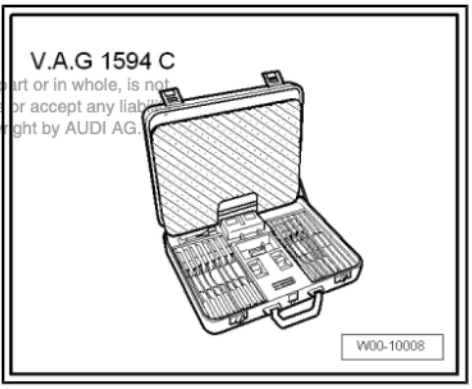
- Remote control for V.A.G 1348 - V.A.G 1348/3A-



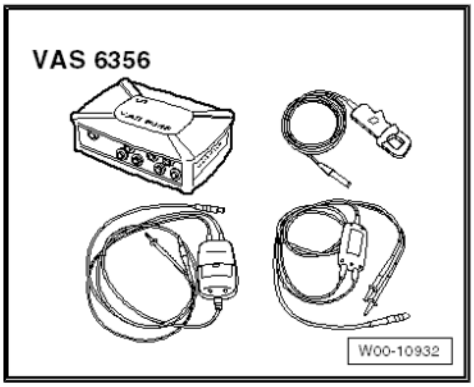
- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-



- Test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A-

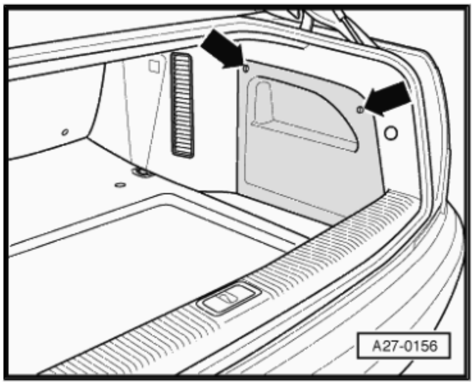


Procedure

– Observe test conditions ⇒ page 3 .

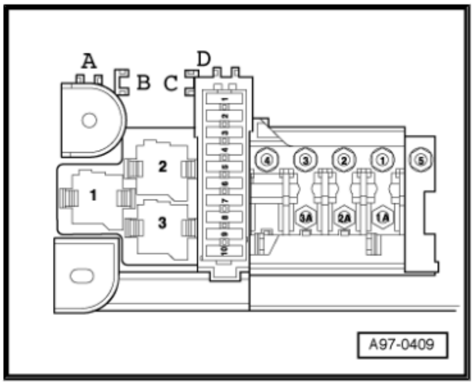
Checking voltage supply

– Remove luggage compartment side trim cover (right-side) -arrows-.



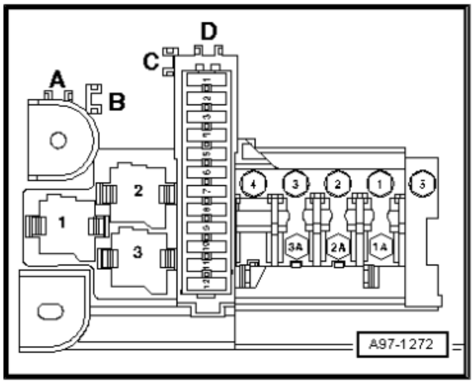
Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).



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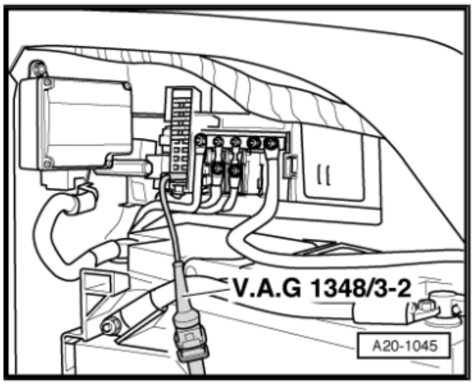
All vehicles (continued):

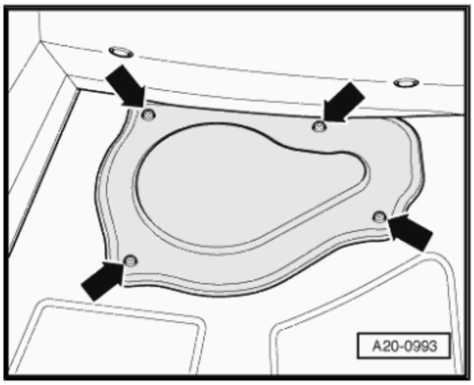


- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.
- Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).
- Press remote control button.
- Fuel pump should start running (noise is audible in vicinity of fuel tank).

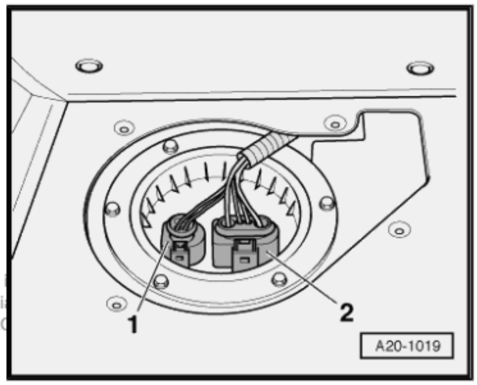
Note

The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

If no noise can be heard from pump:



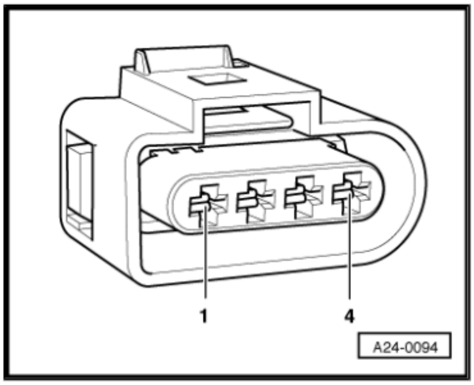
- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



- Unplug electrical connector -2- on flange (left-side).

Note

Disregard -item 1-.



- Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.
- Press remote control button.
- Specification: approx. battery voltage

If specification is not obtained:

- Repair wiring harness according to current flow diagram.

If reading matches specification although no noise can be heard from pump:

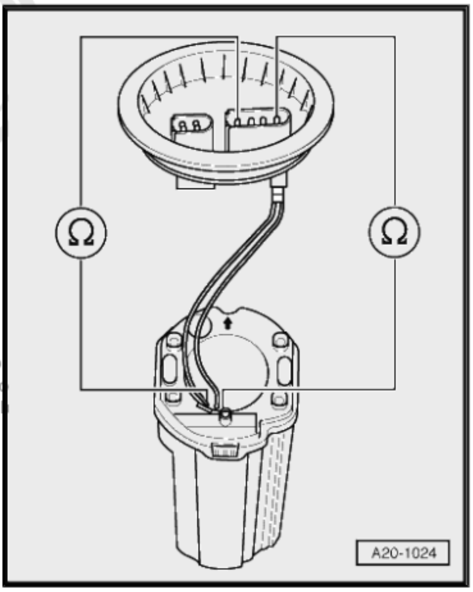
– Remove the fuel delivery unit (left-side) ⇒ page 129 .

– Check that the electrical wires between flange and fuel pump are connected and test for continuity.

If no faults are found in the wiring:

– Fuel pump is defective. Renew the fuel delivery unit (left-side).

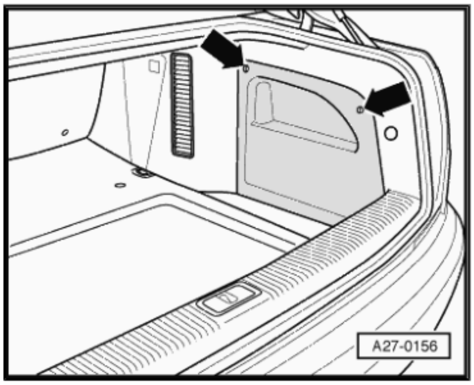
– Install fuel delivery unit (left-side) ⇒ page 75 .



Checking current draw

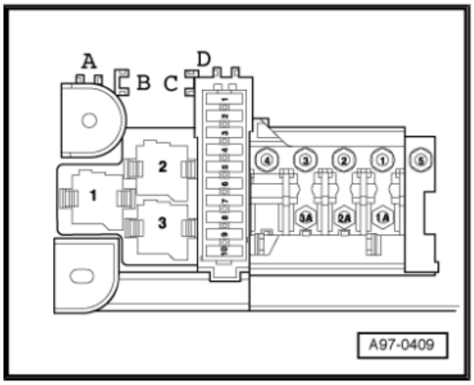
- Fuel pump voltage supply OK ⇒ page 126

– Remove luggage compartment side trim cover (right-side) -arrows-.



Vehicles built in model year 2003:

– Take fuse 10 out of fuse holder SF10 (located in relay and fuse carrier in luggage compartment (right-side), position 10).



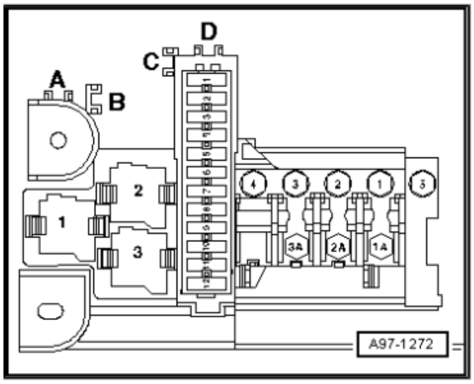
Vehicles from model year 2004 onwards:

– Take fuse 2 out of fuse holder SF2 (located in relay and fuse carrier in luggage compartment (right-side), position 2).

All vehicles (continued):

– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to right-hand terminal of fuse socket from which fuse has been taken out.

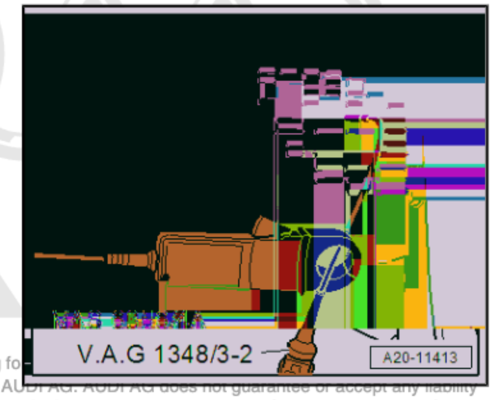
– Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).



- Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
- Press remote control button.
- Measure current draw of fuel pump.

- Specification: approx. 8 A.

If specification is not obtained:



Note

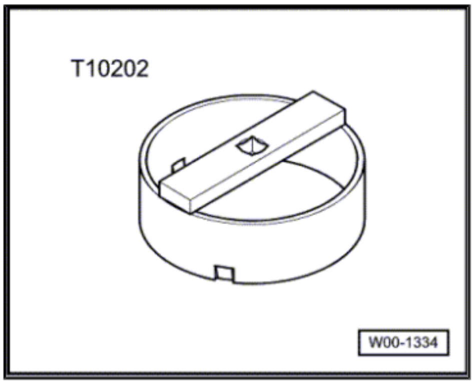
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	◆ Fuel tank empty	– Fill tank
	◆ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 129
0 A	◆ Fuel system pressurisation pump - G6- defective	– Renew fuel delivery unit ⇒ page 129

8.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

- ◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

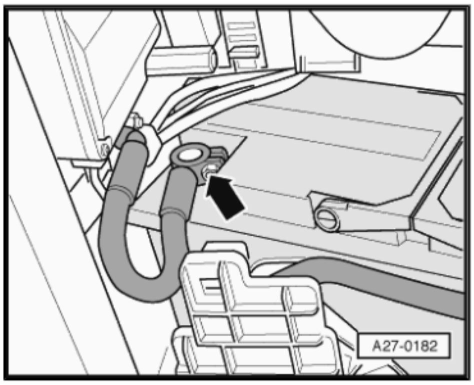
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

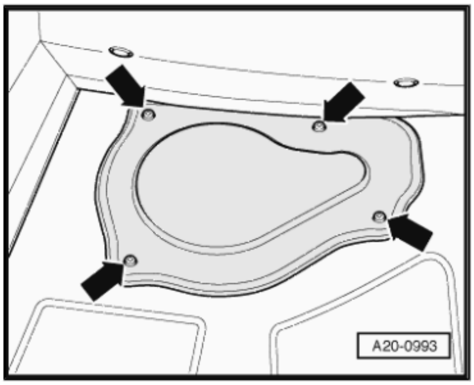


– Remove luggage compartment floor covering.

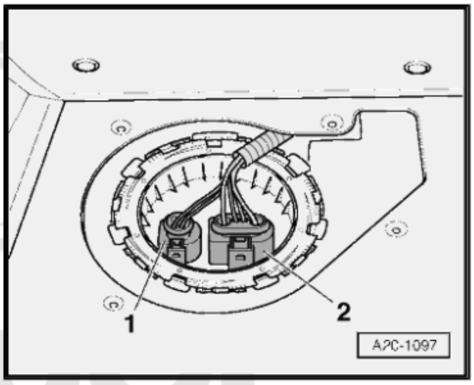
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

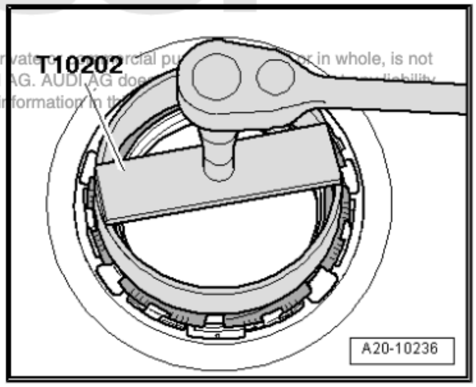
– Detach cover for flange (left-side) -arrows-.



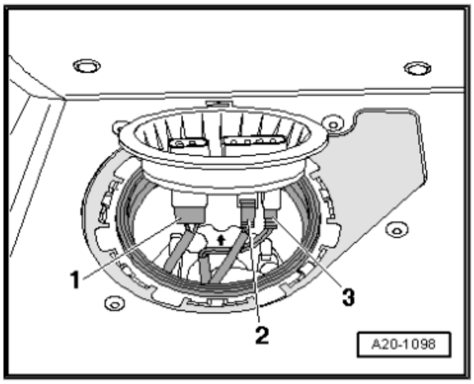
– Unplug electrical connectors -1- and -2- on flange (left-side).



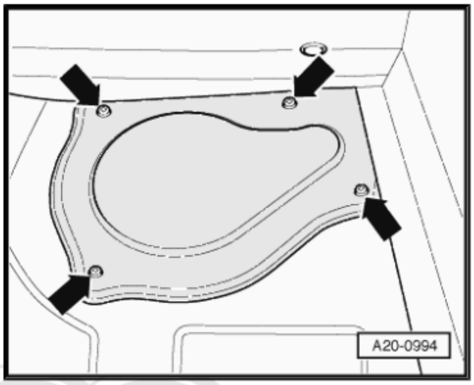
– Unscrew locking ring using wrench - T10202- .



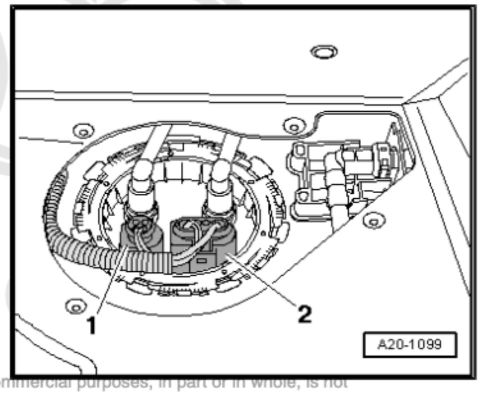
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (right-side).

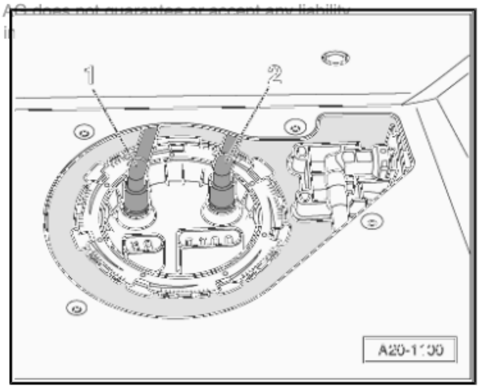


- Mark fuel return line -1- and fuel supply line -2-.

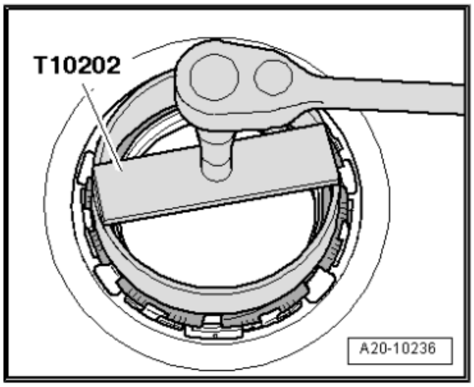
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

- Detach both lines from flange (press release tabs).

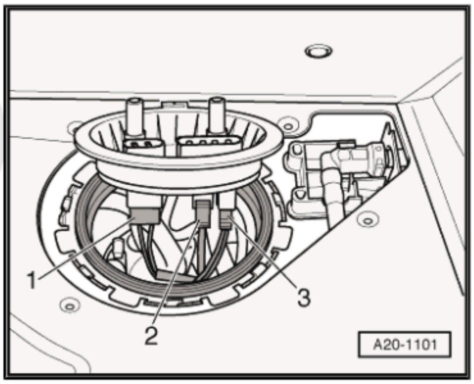


– Unscrew locking ring using wrench - T10202- .



– Detach flange and remove seal.

– Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



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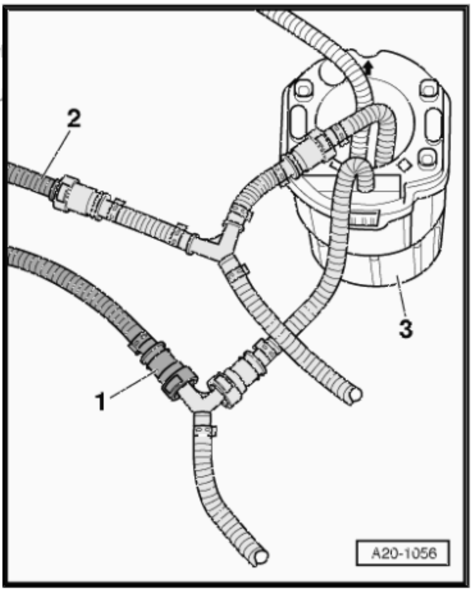
Note

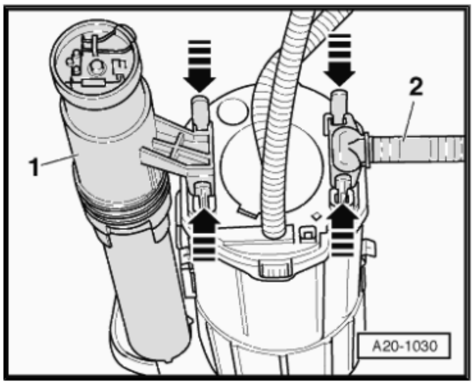
- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*



– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-

– Pull the two disconnected fuel lines out of left fuel tank opening.



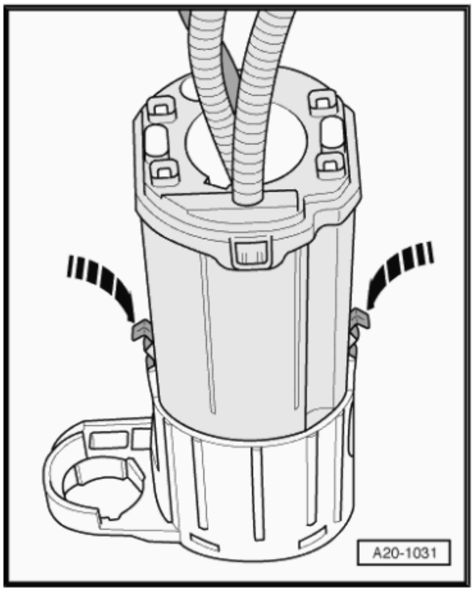
– Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.

– Move fuel gauge sender 3 - G237- to left side.

- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

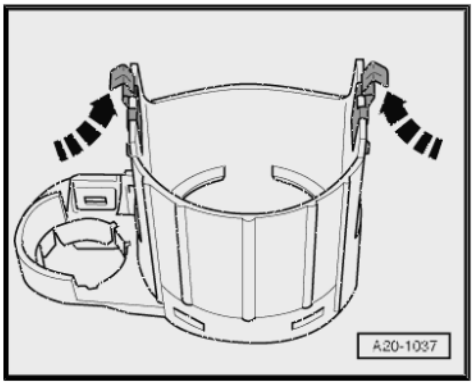
Note

Keep in mind that the fuel delivery unit still contains fuel.

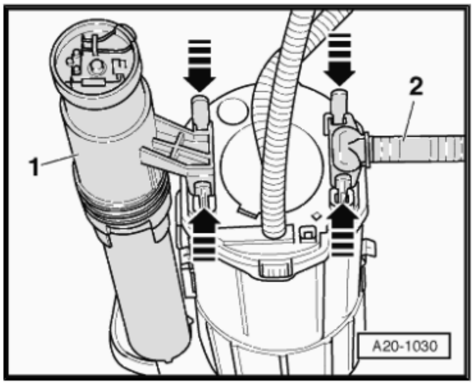


Installing

- Tightening torque ⇒ page 123
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.

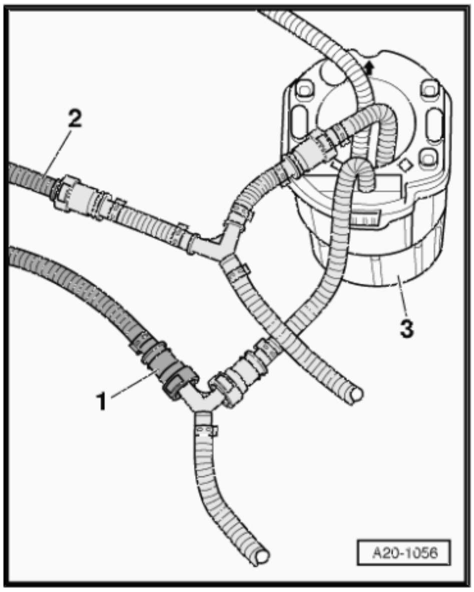


- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
- Guide supply line and return line for fuel delivery unit (left-side) into fuel tank chamber (right-side).

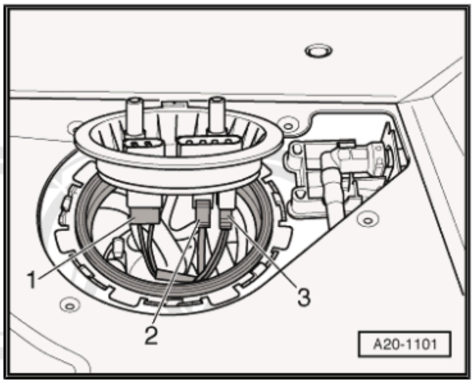


- Fit fuel lines -1- and -2- through right fuel tank opening so that they engage audibly.

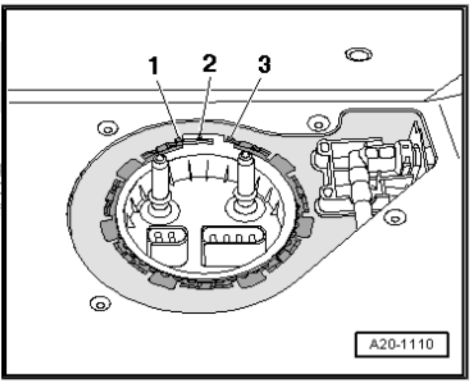
3 - Fuel delivery unit (right-side) with fuel pump - G23-



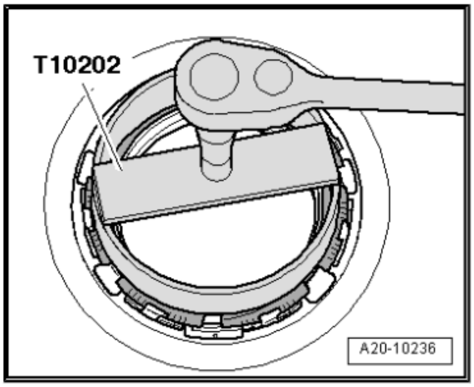
- Connect electrical connectors -1 ... 3- on underside of flange (right-side).
- Install new seal for flange (seal must be installed dry).



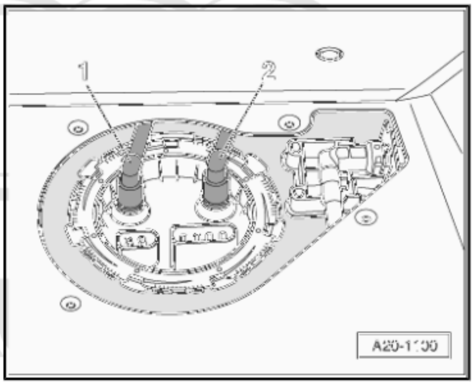
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



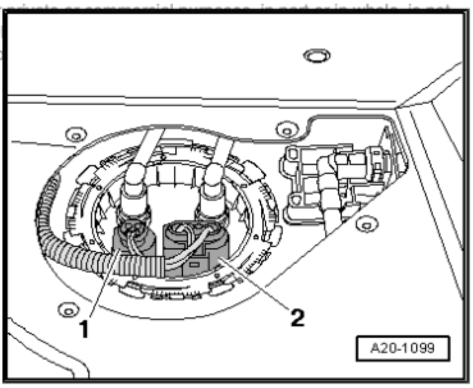
- Tighten locking ring.



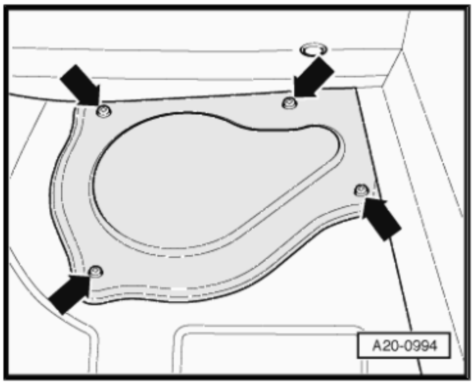
- Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



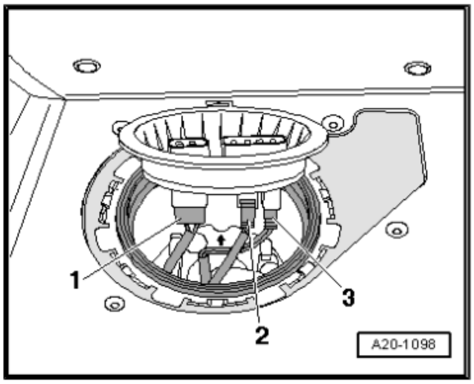
- Attach electrical connectors -1- and -2- on flange (right-side).



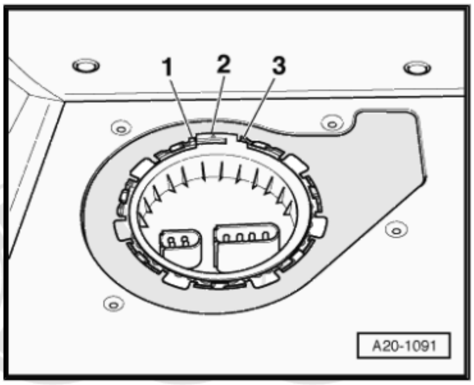
- Secure cover for flange (right-side) -arrows-.



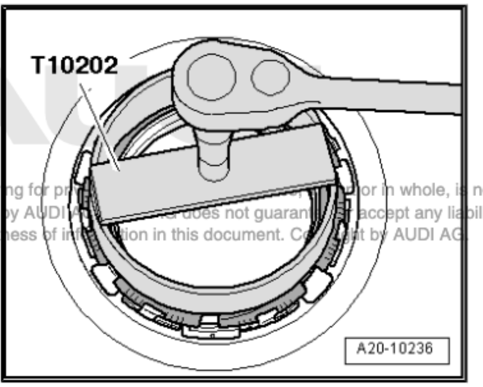
- Connect electrical connectors -1 ... 3- on underside of flange (left-side).
- Install new seal for flange (seal must be installed dry).



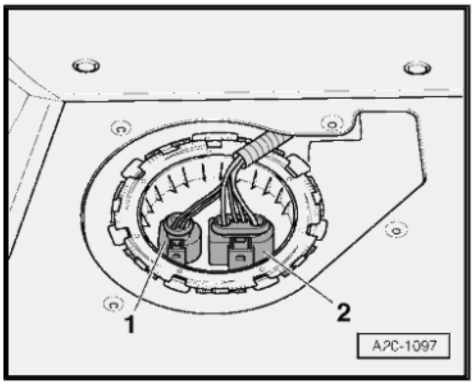
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



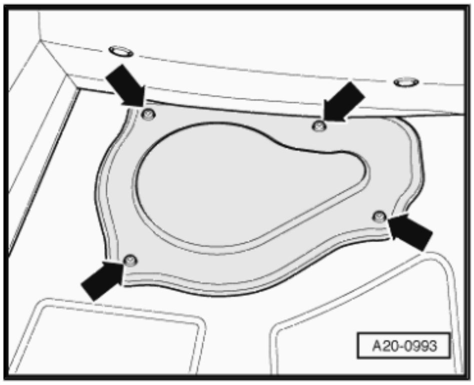
- Tighten locking ring.



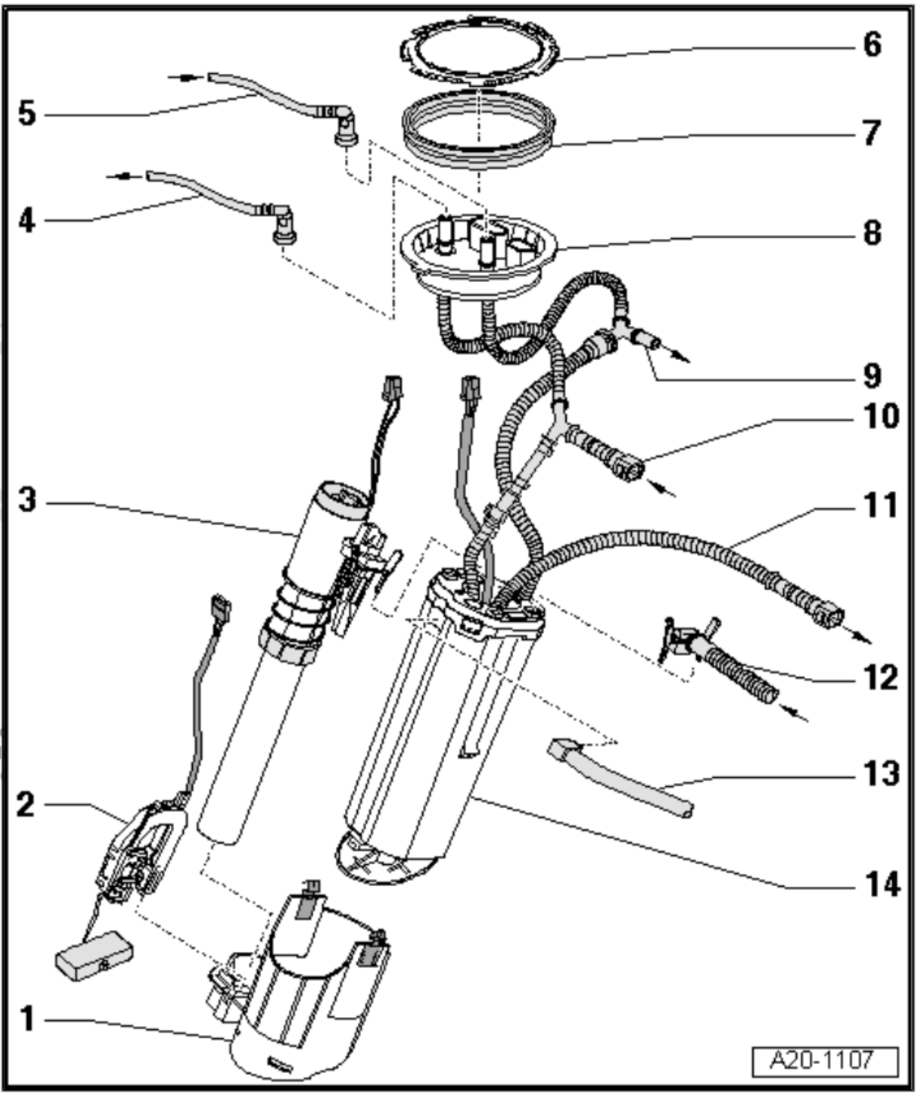
- Attach electrical connectors -1- and -2- on flange (left-side).



- Secure cover for flange (left-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing



8.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-



1 - Retainer

- ❑ For fuel delivery unit

2 - Fuel gauge sender 2 -G169-

- ❑ Yellow
- ❑ Clipped onto retainer -item 1-
- ❑ Checking resistance values ⇒ page 223
- ❑ Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 -G393-

- ❑ White
- ❑ Clipped onto fuel delivery unit -item 14-
- ❑ Checking resistance values ⇒ page 230
- ❑ Removing and installing ⇒ page 232

4 - Fuel supply line

- ❑ To fuel filter
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

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5 - Fuel return line

- ❑ From fuel rail
- ❑ Mark before removing
- ❑ Press release tab on connection piece to disconnect
- ❑ Do not kink
- ❑ Clip onto fuel tank

6 - Locking ring

- ❑ Remove and install using wrench - T10202-
- ❑ Tighten to 120 Nm

7 - Seal

- ❑ Renew
- ❑ Install dry

8 - Flange (right-side)

- ❑ Installation position ⇒ page 138

9 - Fuel return line

- ❑ To fuel delivery unit (left-side)

10 - Fuel supply line

- ❑ From fuel delivery unit (left-side)
- ❑ Press release tab on connection piece to disconnect

11 - Supply line for suction-jet pump

- ❑ For suction-jet pump
- ❑ Press release tab on connection piece to disconnect

12 - Fuel supply line

- ❑ From suction-jet pump (left-side)
- ❑ Clipped onto fuel delivery unit -item 14-

13 - Fuel filler pipe

- ❑ From filler neck
- ❑ Clipped onto fuel delivery unit -item 14-

14 - Fuel delivery unit (right-side)

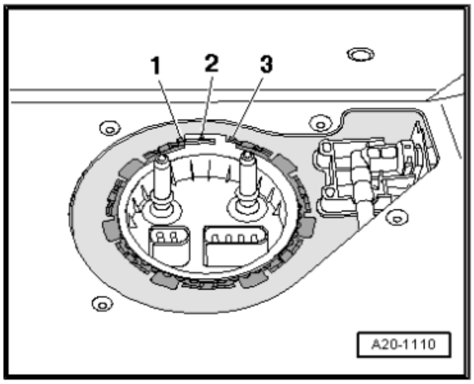
- ❑ With fuel pump - G23-
- ❑ Clipped onto retainer -item 1-
- ❑ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ❑ Checking fuel pump (electrical test) ⇒ page 138
- ❑ Checking residual pressure ⇒ Rep. gr. 24
- ❑ Removing and installing ⇒ page 141
- ❑ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

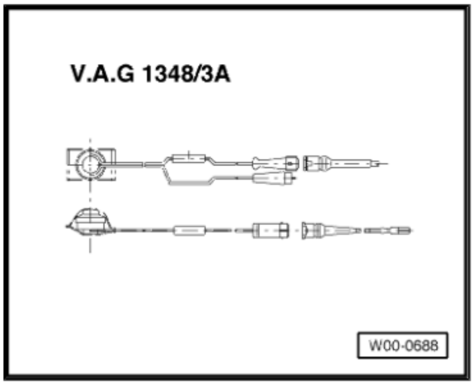
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



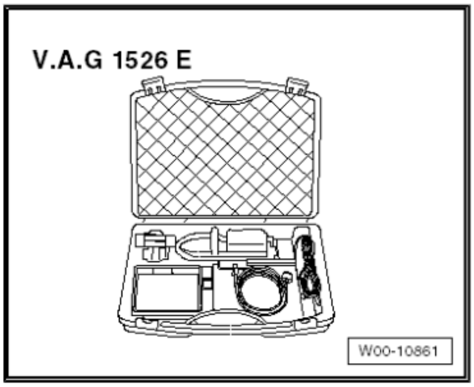
8.5 Checking fuel pump - G23- (right-side) - electrical test

Special tools and workshop equipment required

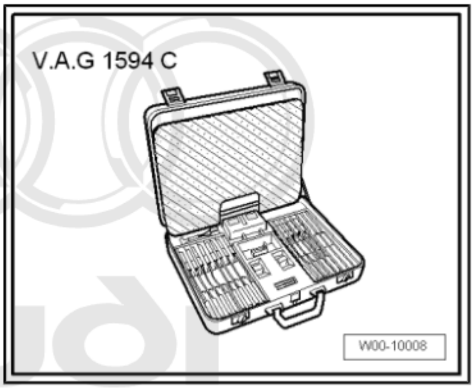
◆ Remote control for V.A.G 1348 - V.A.G 1348/3A-



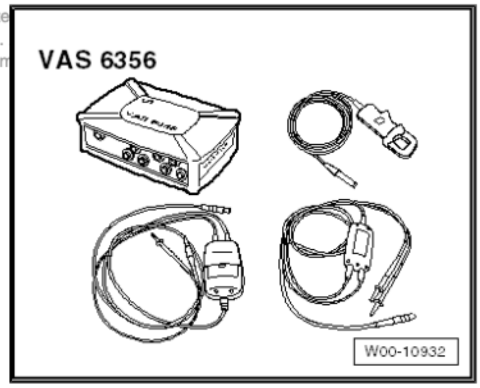
- Hand-held multimeter - V.A.G 1526 E-



- Auxiliary measuring set - V.A.G 1594C-



- Test instrument box - VAS 6356- with trigger clamp, 100 A- VAS 6356/4A-

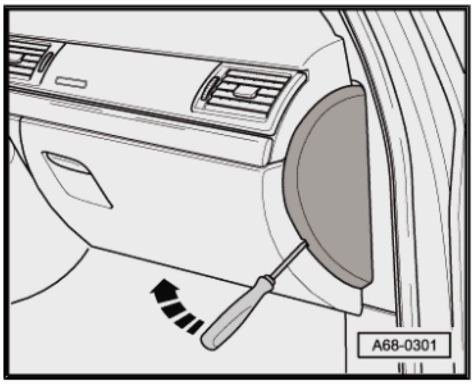


Procedure

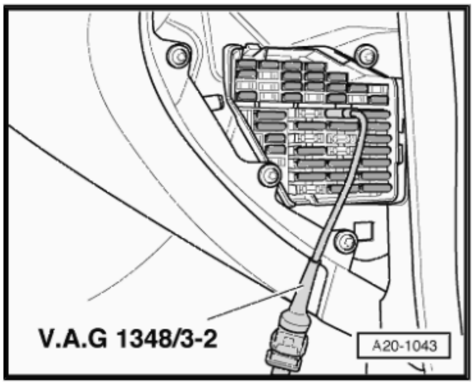
– Observe test conditions ⇒ page 3 .

Checking voltage supply

– Use screwdriver to pry off cover (right-side) at dash panel -arrow-.



- Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).
- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.
- Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery “+” (positive).
- Press remote control button.
- Fuel pump should start running (noise is audible in vicinity of fuel tank).

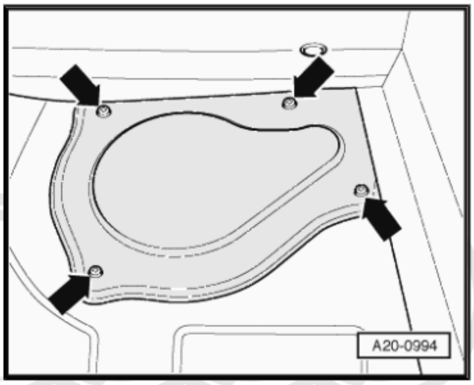


Note

The fuel pump runs very quietly. Avoid background noise whilst checking fuel pump. Have second mechanic perform check if necessary.

If no noise can be heard from pump:

- Remove luggage compartment floor covering.
- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connector -2- on flange (right-side).

Note

Disregard -item 1-.

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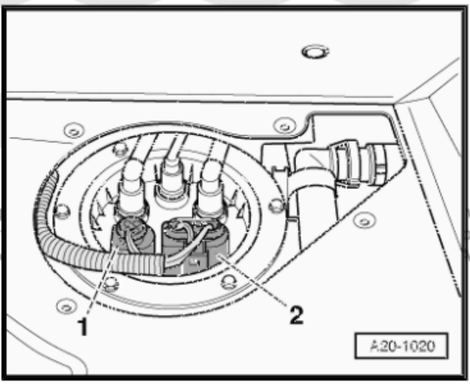
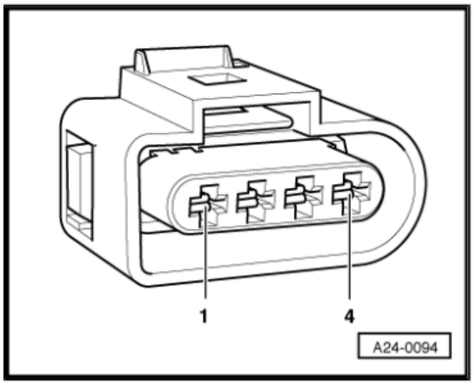
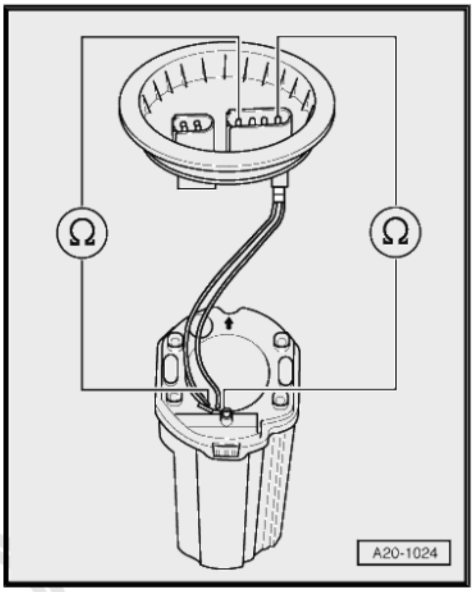


- Connect multimeter between contacts -1- and -4- of electrical connector to measure voltage.
- Press remote control button.
- Specification: approx. battery voltage

If specification is not obtained:

- Repair wiring harness according to current flow diagram.





If reading matches specification although no noise can be heard from pump:

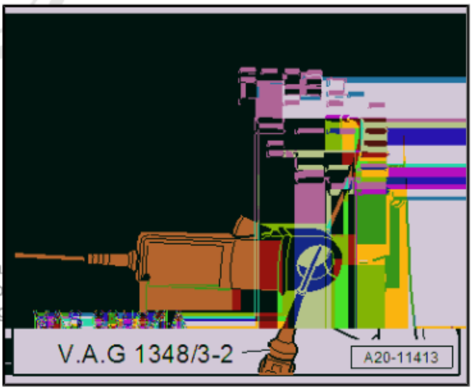
- Remove fuel delivery unit (right-side) ⇒ page 141 .
- Check that the electrical wires between flange and fuel pump are connected and test for continuity.

If no faults are found in the wiring:

- Fuel pump is defective. Renew fuel delivery unit (right-side).
- Install fuel delivery unit (right-side) ⇒ page 86 .

Checking current draw

- Fuel pump voltage supply OK ⇒ page 139
- Take fuse 31 out of fuse holder SC31 (right side of dash panel, middle row, 1st large fuse from the top).
- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable - V.A.G 1348/3-2- to left-hand fuse socket terminal of fuse SC31.
- Connect crocodile clip of remote control - V.A.G 1348/3A- for V.A.G 1348 to battery "+" (positive).



- Connect test instrument box - VAS 6356- with trigger clamp, 100 A - VAS 6356/4A- to cable of remote control.
- Press remote control button.
- Measure current draw of fuel pump.
- Specification: approx. 8 A.

If specification is not obtained:

Note

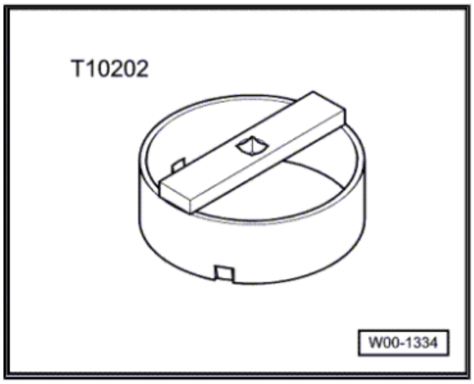
A current draw of 4 A indicates that the fuel pump is running dry.

Readout	Cause of fault	Remedy
approx. 4 A	◆ Fuel tank empty	– Fill tank
	◆ Housing of fuel delivery unit leaking	– Renew fuel delivery unit ⇒ page 141
0 A	◆ Fuel pump - G23- defective	– Renew fuel delivery unit ⇒ page 141

8.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

- Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

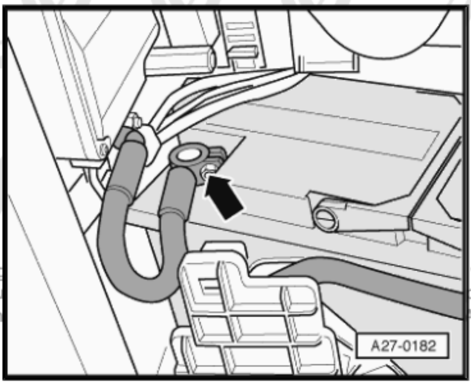
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .



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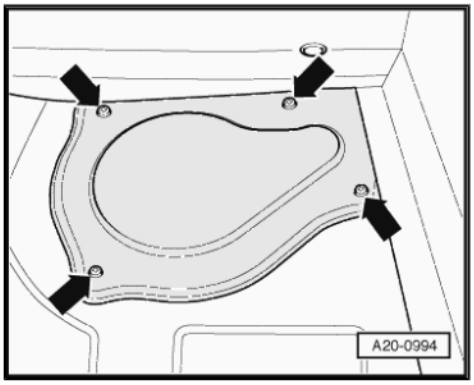
– Remove luggage compartment floor covering.

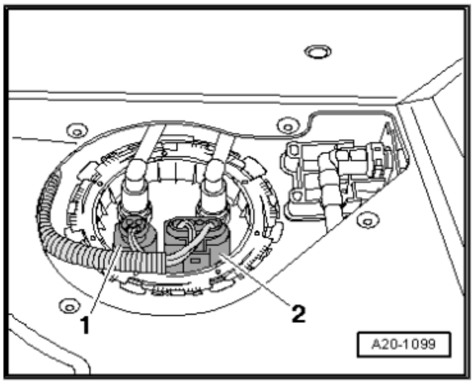
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.

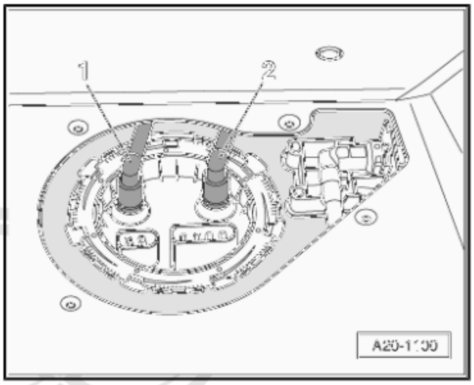


- Unplug electrical connectors -1- and -2- on flange (right-side).



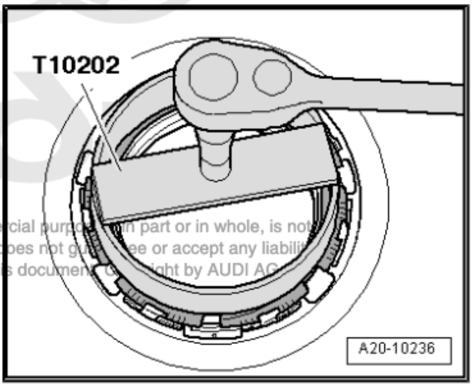
- Mark fuel return line -1- and fuel supply line -2-.

> WARNING
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*

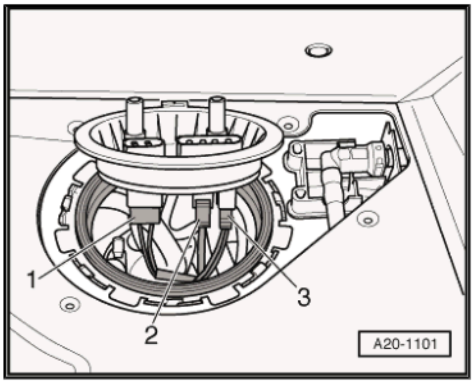


- Detach both lines from flange (press release tabs).

- Unscrew locking ring using wrench - T10202- .



- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

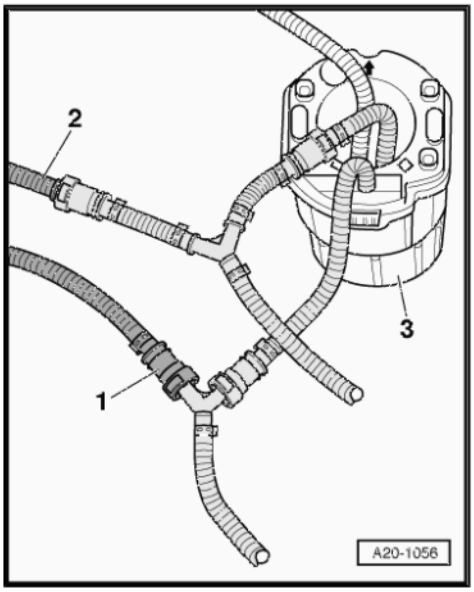


Note

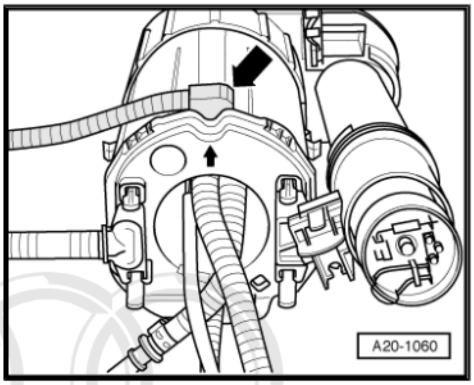
- ♦ *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- ♦ *For illustration purposes some of the components are shown removed in the following illustrations.*

– Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

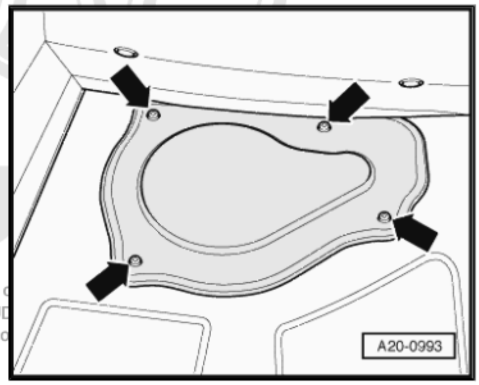
3 - Fuel delivery unit (right-side) with fuel pump - G23-



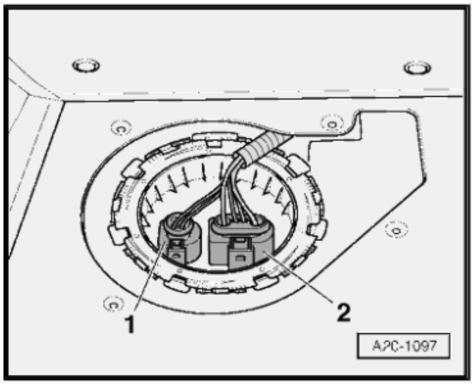
– Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



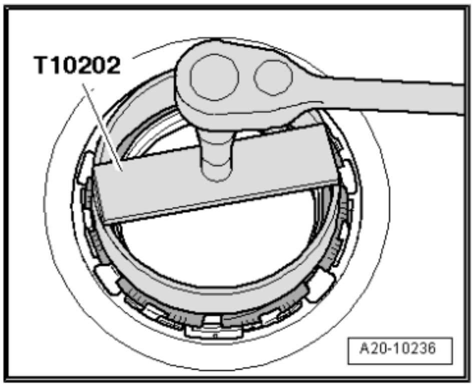
– Detach cover for flange (left-side) -arrows-.



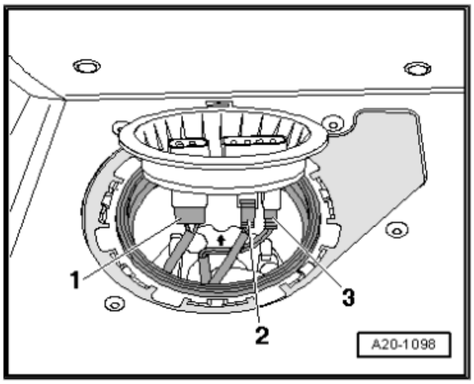
– Unplug electrical connectors -1- and -2- on flange (left-side).



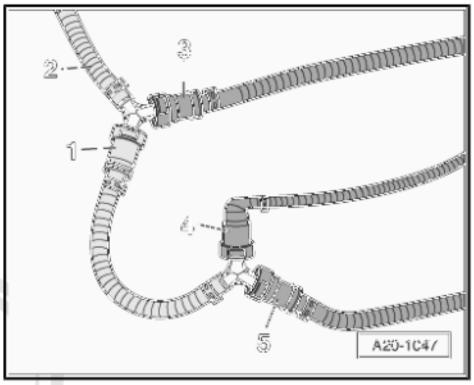
- Unscrew locking ring using wrench - T10202- .



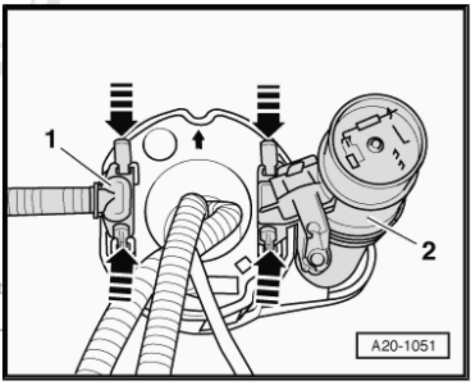
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Working through left fuel tank opening, disconnect supply line -3- for suction-jet pump from Y-connector (press release tab).
- Pull supply line for suction-jet pump out of right fuel tank opening.



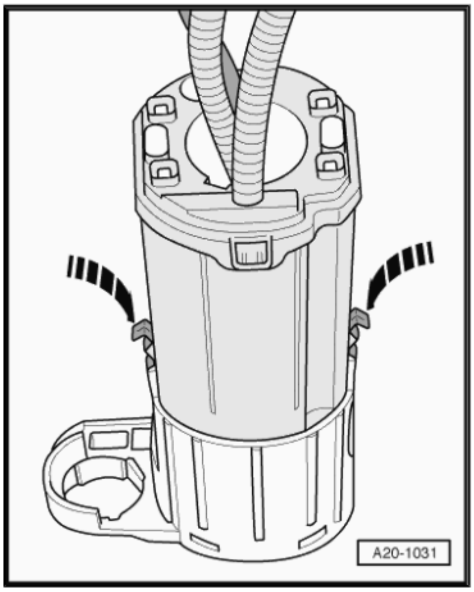
- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

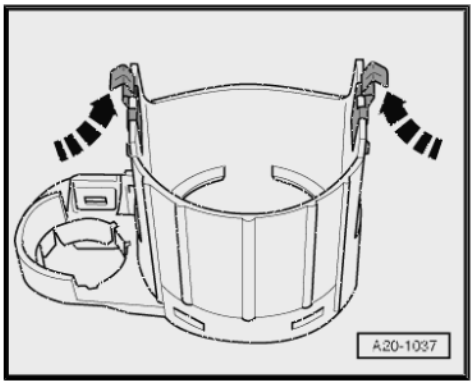
Note

Keep in mind that the fuel delivery unit still contains fuel.

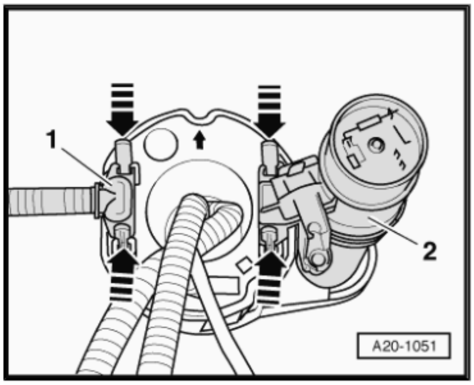


Installing

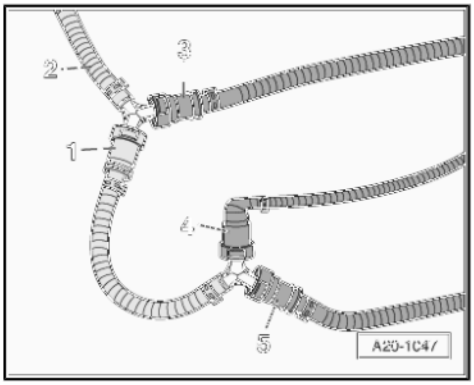
- Tightening torque ⇒ page 136
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



- Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).

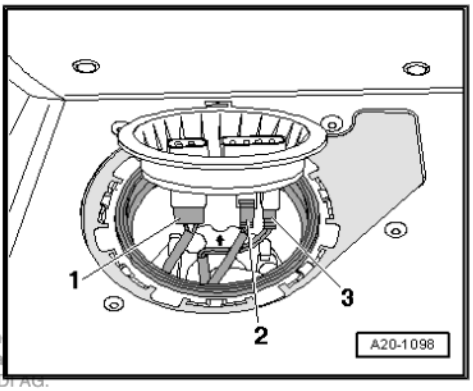


- Push supply line -3- for suction-jet pump through right fuel tank opening into left fuel tank chamber.
- Fit supply line for suction-jet pump onto Y-connector so it engages audibly.



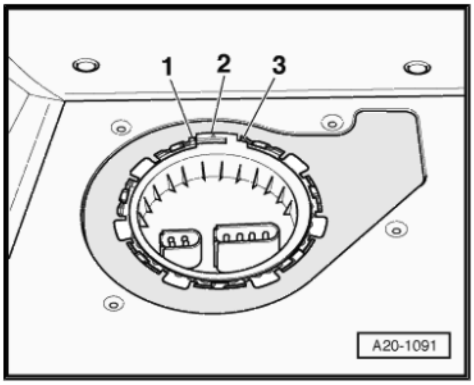
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

– Install new seal for flange (seal must be installed dry).

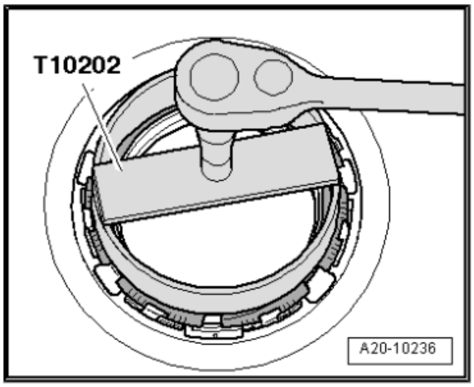


– Fit flange into fuel tank; note correct installation position:

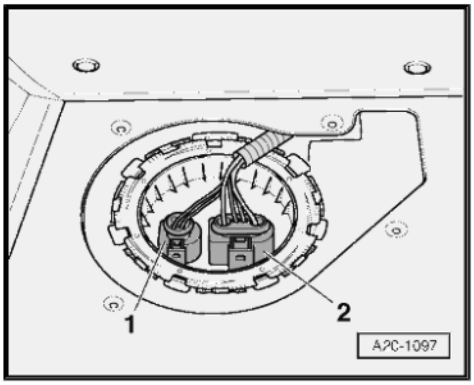
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



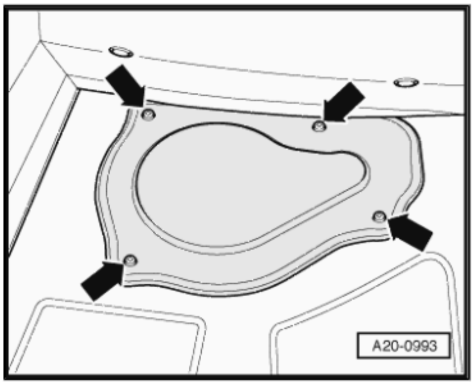
– Tighten locking ring.



– Attach electrical connectors -1- and -2- on flange (left-side).

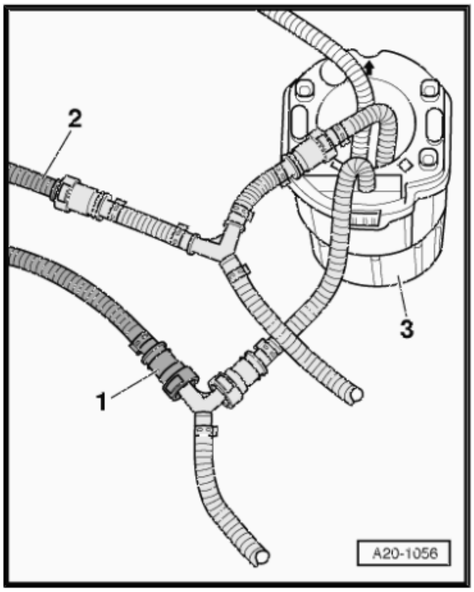


– Secure cover for flange (left-side) -arrows-.



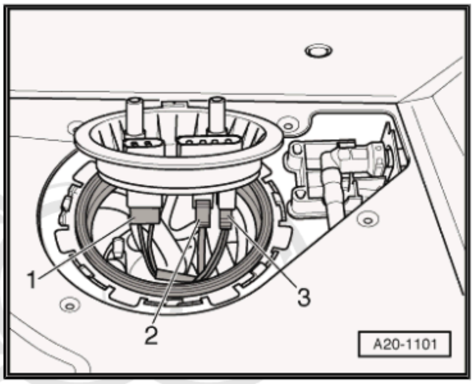
– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



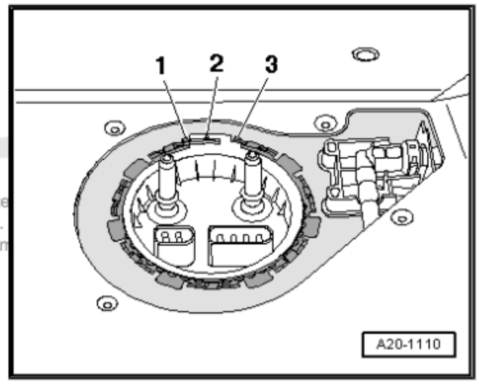
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

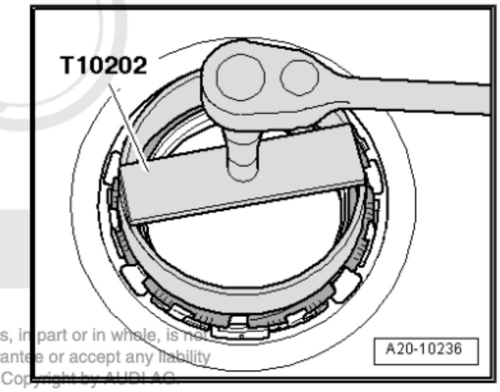


– Fit flange into fuel tank; note correct installation position:

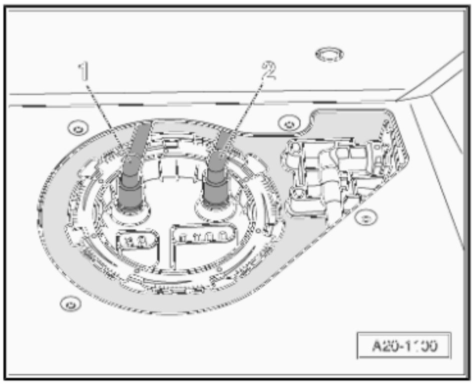
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



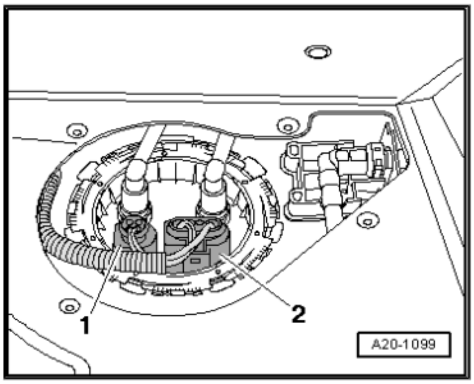
- Tighten locking ring.



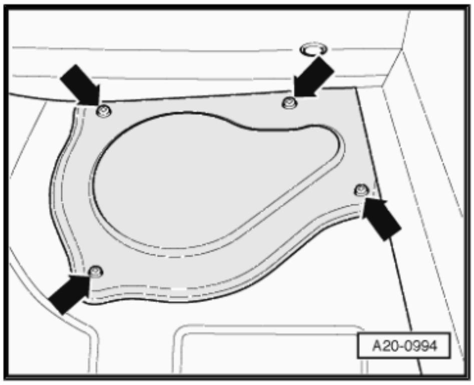
- Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



- Attach electrical connectors -1- and -2- on flange (right-side).



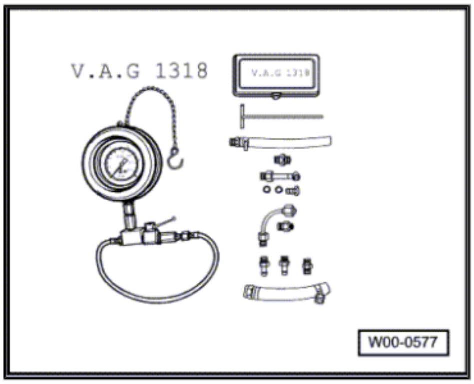
- Secure cover for flange (right-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing



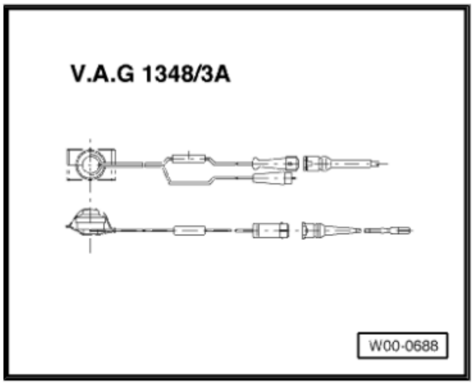
8.7 Checking delivery rate of fuel pumps - vehicles with fuel return line

Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

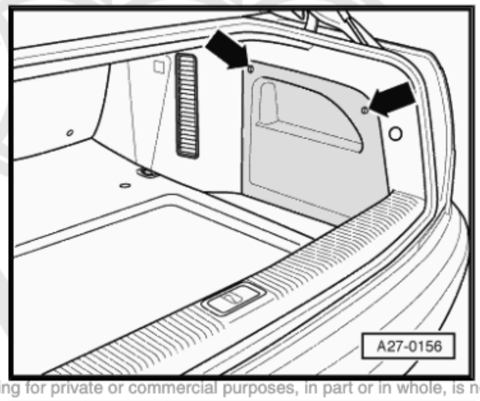
Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

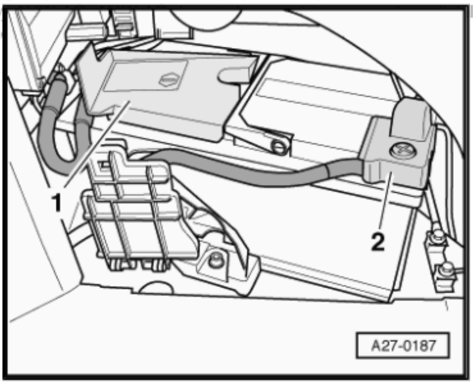
– Remove luggage compartment side trim cover (right-side) -arrows-.



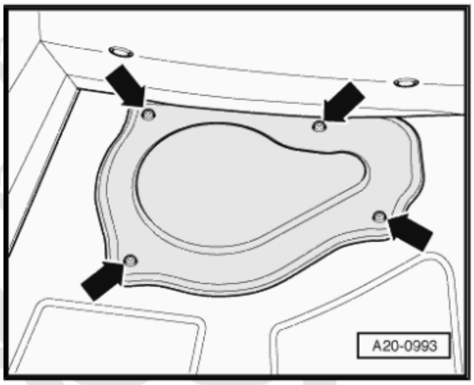
– Remove cover -2- over battery.

Note

Disregard -item 1-.



- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



- Unplug electrical connector -2- on flange (left-side).

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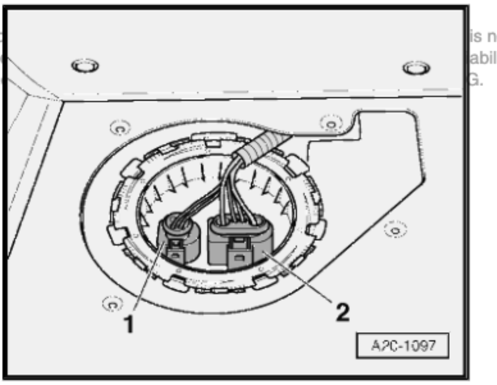
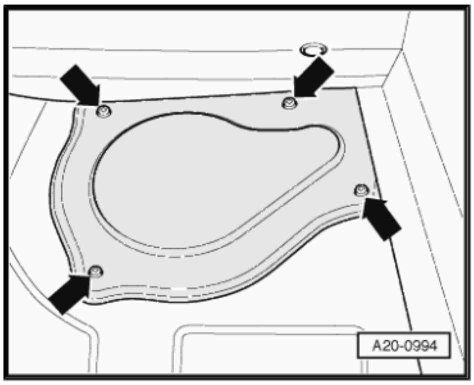


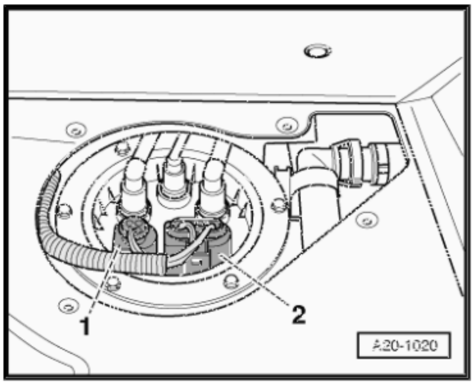
Note

Disregard -item 1-.

- Unscrew cover for flange (right-side) -arrows-.



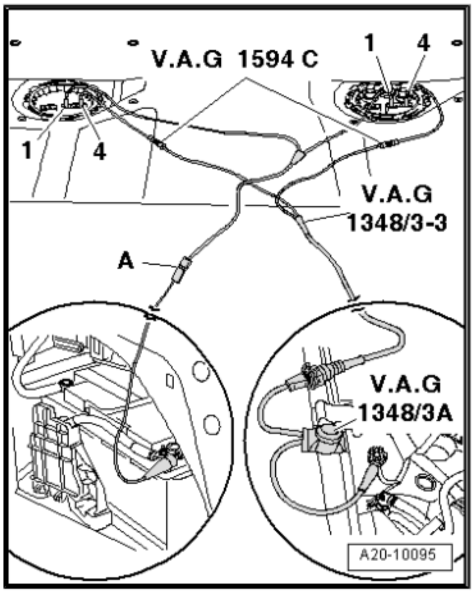
- Unplug electrical connector -2- on flange (right-side).

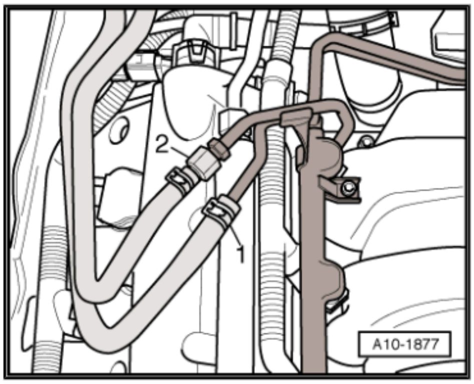


Note

Disregard -item 1-.

- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
- Connect crocodile clip to earth point in engine compartment.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery "+" via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.





WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

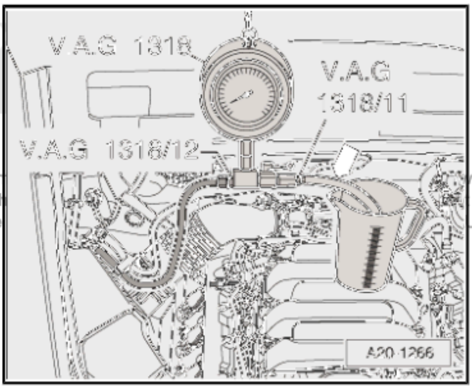
Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .

- Disconnect fuel supply line -2- at fuel rail.

Note

Disregard -item 1-.



- Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.
- Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.
- Open cut-off valve on pressure tester. Lever must point in direction of flow.
- Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.
- Specification: 4 bar
- From this point on do not move position of cut-off valve.
- Empty the measuring container.

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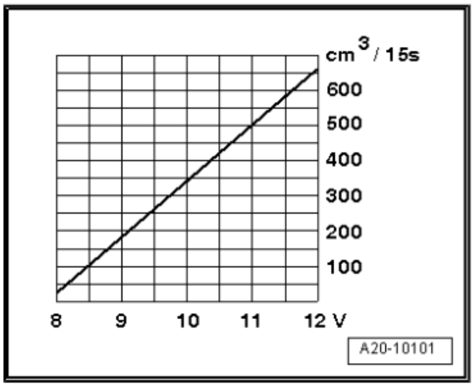
- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

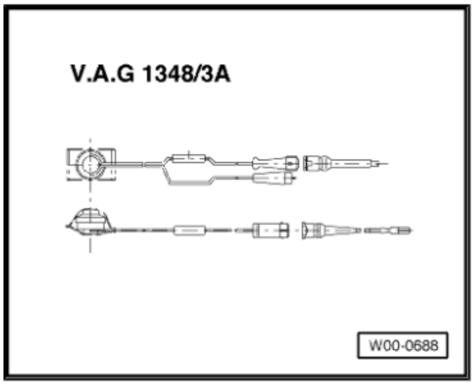
Installation is carried out in the reverse order; note the following:

- Secure fuel supply line to fuel rail ⇒ Rep. gr. 24 .

8.8 Checking delivery rate of fuel pumps - vehicles with fuel system without fuel return line

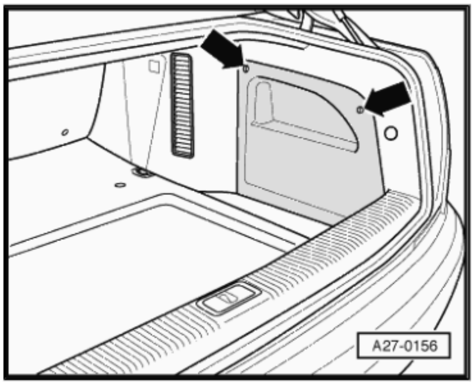
Special tools and workshop equipment required

- Adapter -V.A.G 1318/26-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



- Fuel-resistant measuring container

Procedure

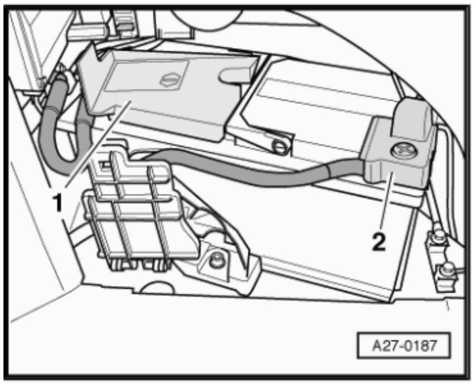


- Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .

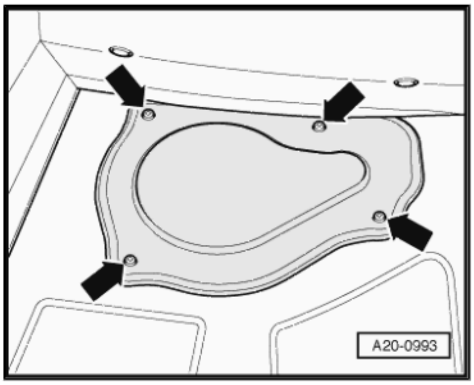
- Remove luggage compartment side trim cover (right-side) -arrows-.



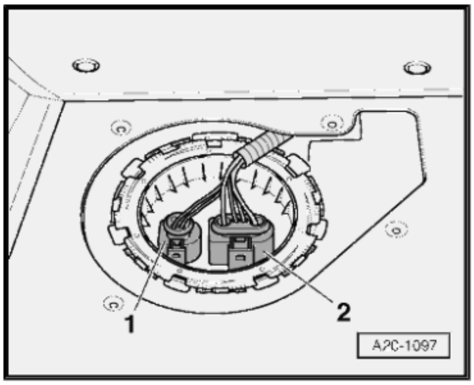
- Remove cover -2- over battery.

Note

Disregard -item 1-.



- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.

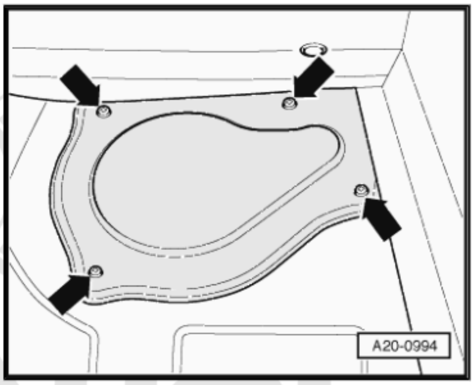


- Unplug electrical connector -2- on flange (left-side).

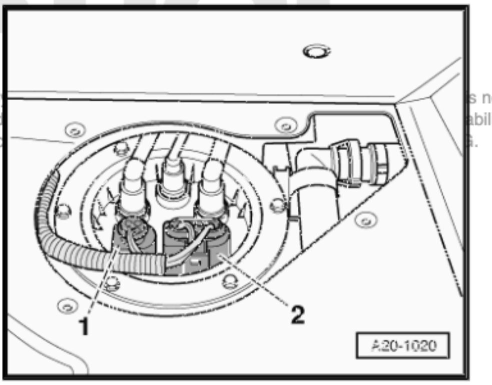
Note

Disregard -item 1-.

– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.

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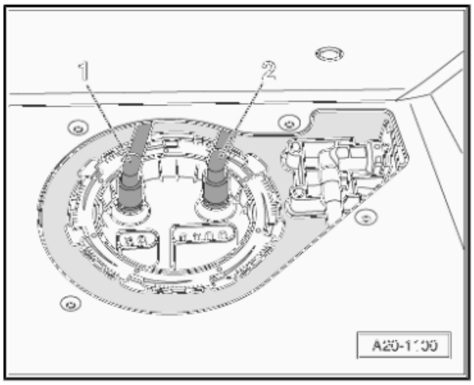
> **WARNING**
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*

> **Caution**
>
> *Rules for cleanliness when working on the injection system ⇒ page 3 .*

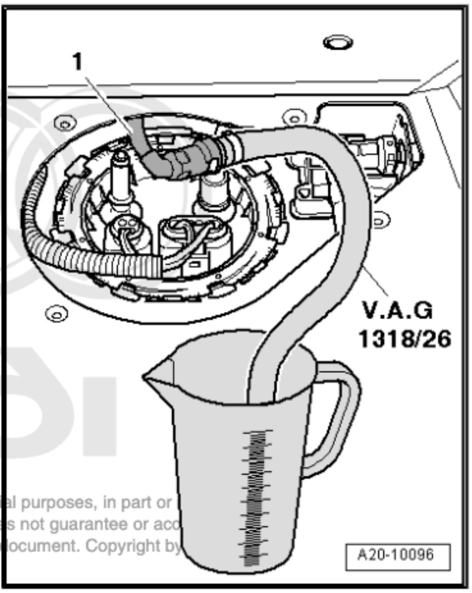


– Disconnect fuel return line -1- from flange by pressing release tabs.

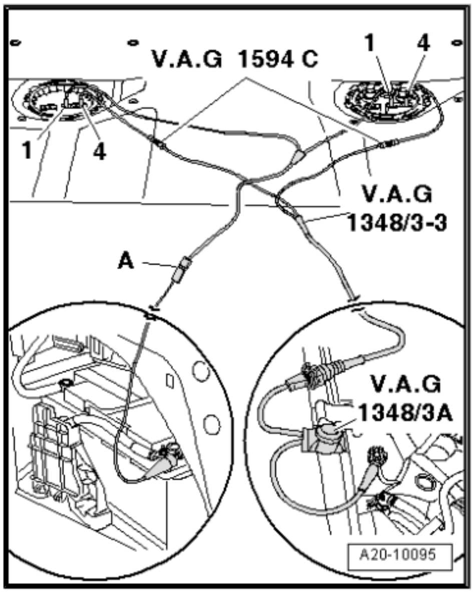
Note

Disregard -item 2-.

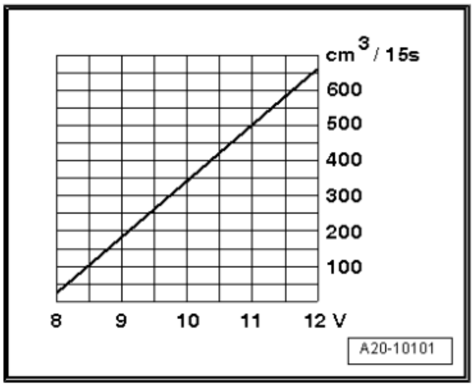
- Fit adapter -V.A.G 1318/26- onto disconnected fuel pipe -1- and hold adapter hose in measuring container.



- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Connect crocodile clip to earth point next to battery.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery “+” via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.



- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pumps are defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

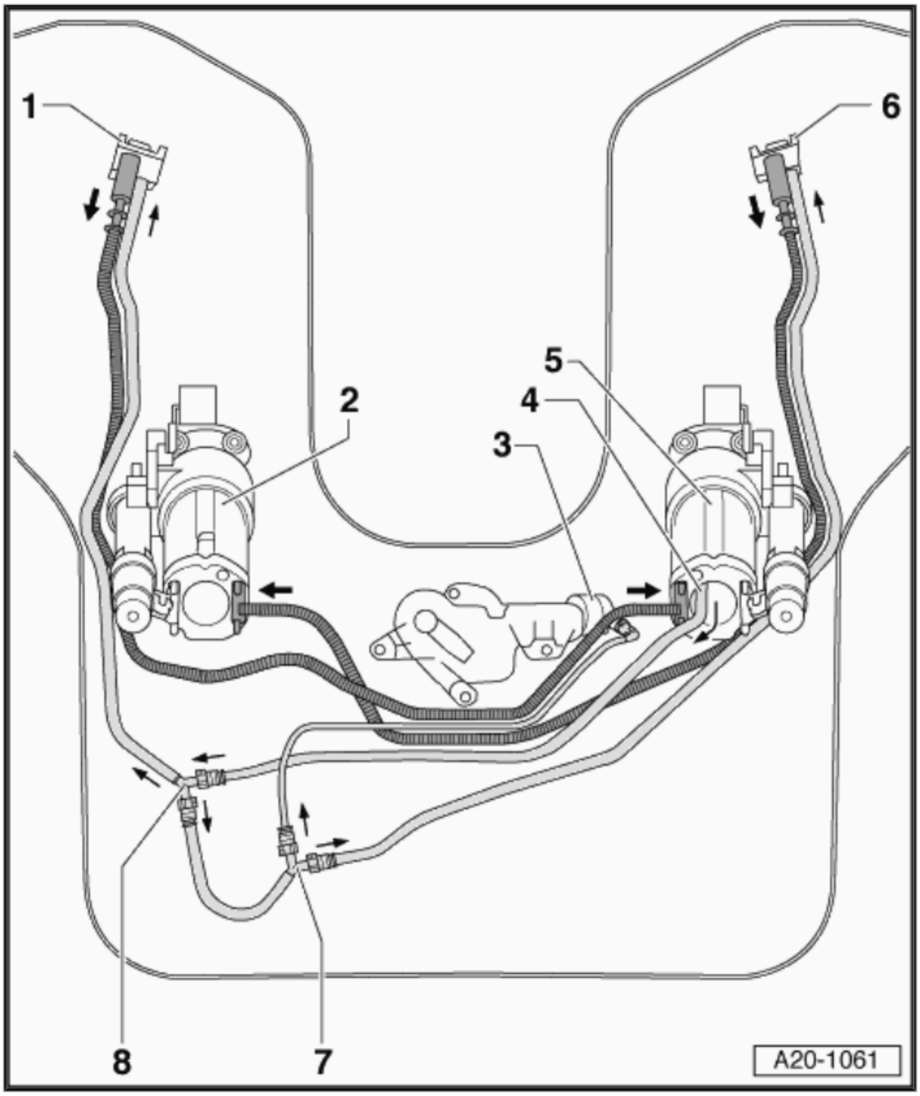
In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

8.9 Suction-jet pumps



1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel pump (right-side)

5 - Fuel delivery unit (right-side)

6 - Suction-jet pump (right-side)

7 - Y-connector

8 - Y-connector

Description of operation

To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

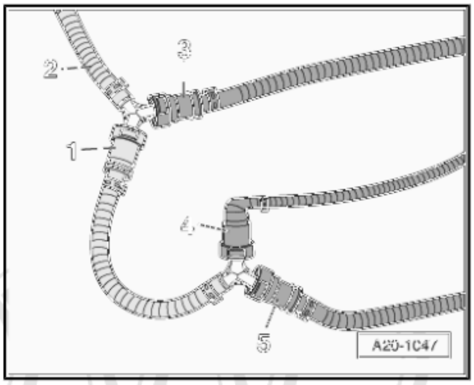
- For this reason, the fuel delivery units -item 2- and -item 5- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pump (right-side) -item 4- is passed through a nozzle in the suction-jet pumps -item 1- and -item 6-, and is thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 6- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- The stream of fuel is distributed from the primary stage of the fuel pump (right-side) to the two suction-jet pumps via two Y-connectors -item 7- and -item 8-.
- Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

8.10 Removing and installing suction-jet pump (left-side)

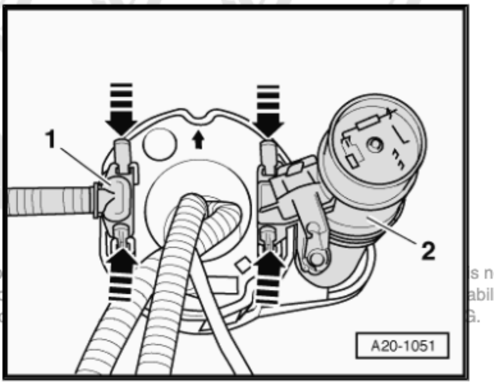
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .



- Remove the fuel delivery unit (left-side) ⇒ page 129 .
- Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.
- Working through left fuel tank opening, disconnect supply lines -1- and -3- for suction-jet pumps from Y-connector (press release tabs).



- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.

Note

Disregard -item 2-.

- Pull out disconnected fuel supply line through left fuel tank opening.

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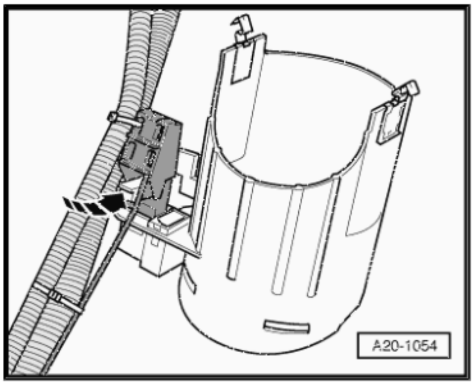
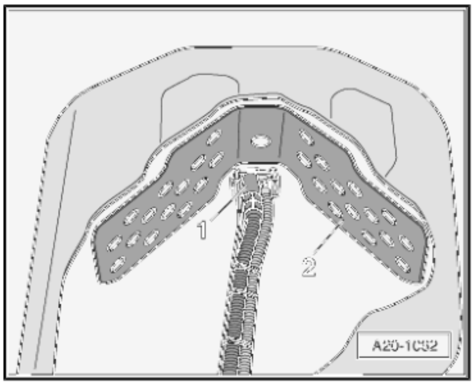


- Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.

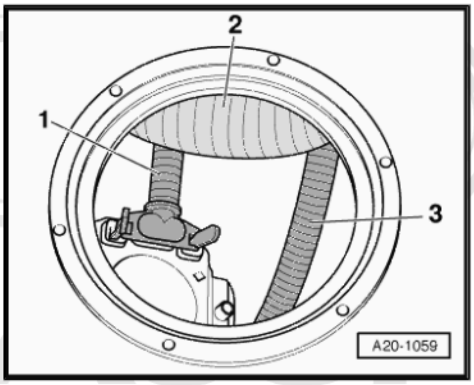
Installing



- Insert suction-jet pump (left-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.

- Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:

- The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 1-.

- Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

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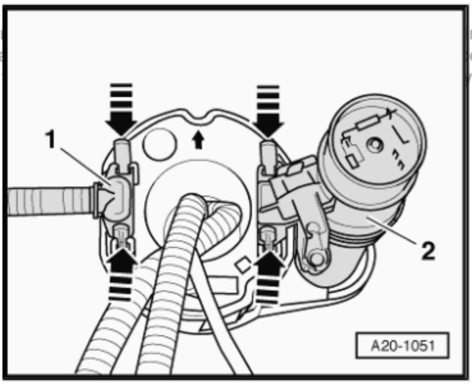
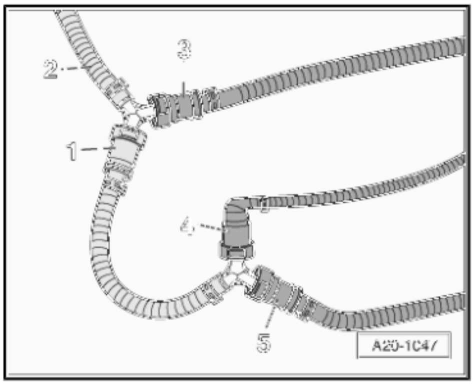


Note

Disregard -item 2-.

- Working through left fuel tank opening, fit supply lines -1- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.
- Insert fuel gauge sender 3 - G237- into fuel tank.
- Install fuel delivery unit (left-side) ⇒ page 129 .



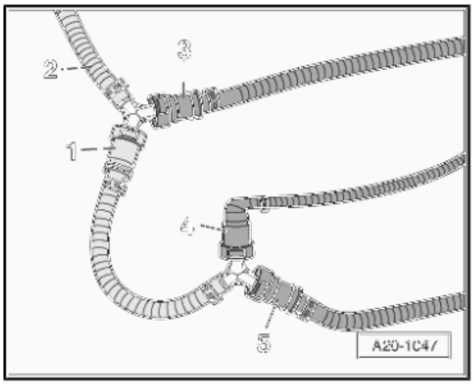
8.11 Removing and installing suction-jet pump (right-side)

Removing

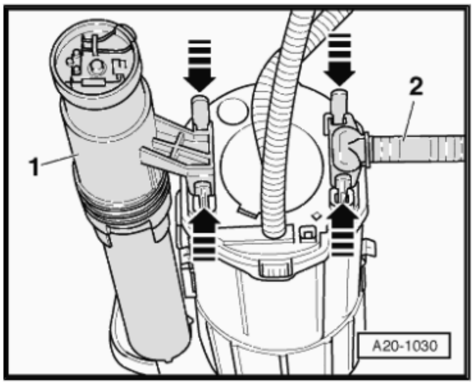
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- Remove fuel delivery unit (right-side) ⇒ page 141 .
- Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
- Working through left fuel tank opening, disconnect supply line -5- for suction-jet pump from Y-connector (press release tab).



- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.



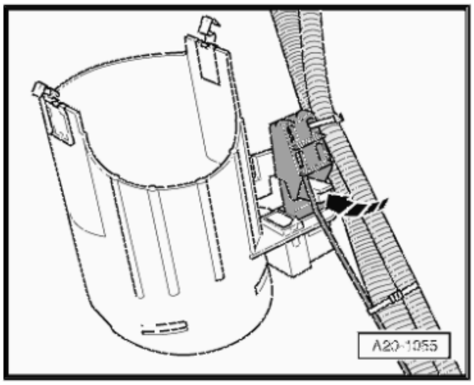
Note

Disregard -item 1-.

- Pull out disconnected fuel supply line through right fuel tank opening.

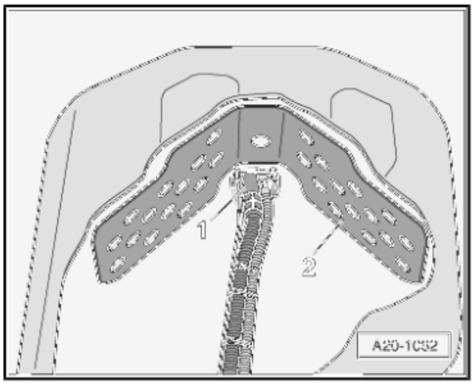
- Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.

- Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.

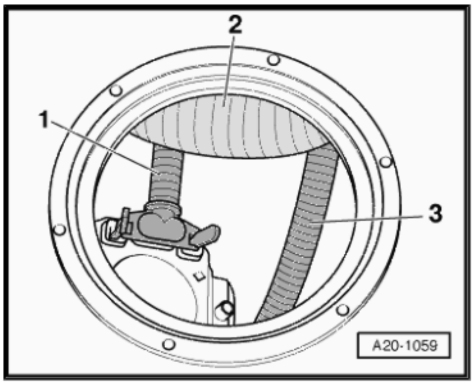


Installing

- Insert suction-jet pump (right-side) -1- into fuel tank and place into recess in baffle plate -2- in fuel tank at front, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.



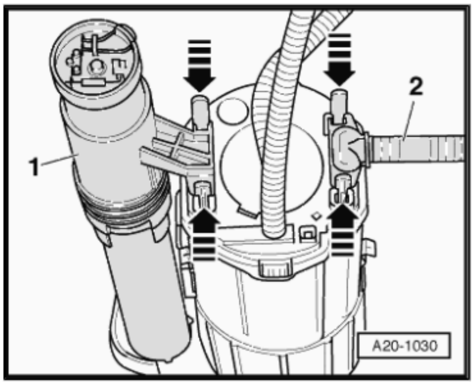
- Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:
- The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.



Note

Disregard -item 3-.

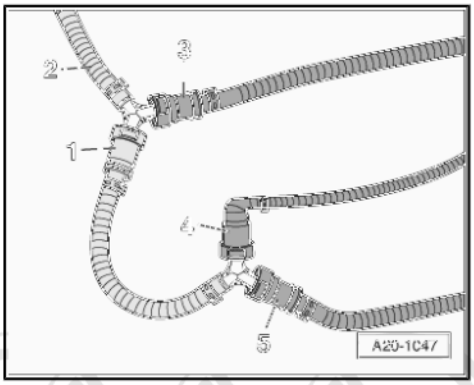
- Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.



Note

Disregard -item 1-.

- Push supply line -5- for suction-jet pump through right fuel tank opening into left fuel tank chamber.
- Fit supply line for suction-jet pump onto Y-connector so it engages audibly.
- Insert fuel gauge sender 4 - G393- into fuel tank.
- Install fuel delivery unit (right-side) ⇒ page 86 .



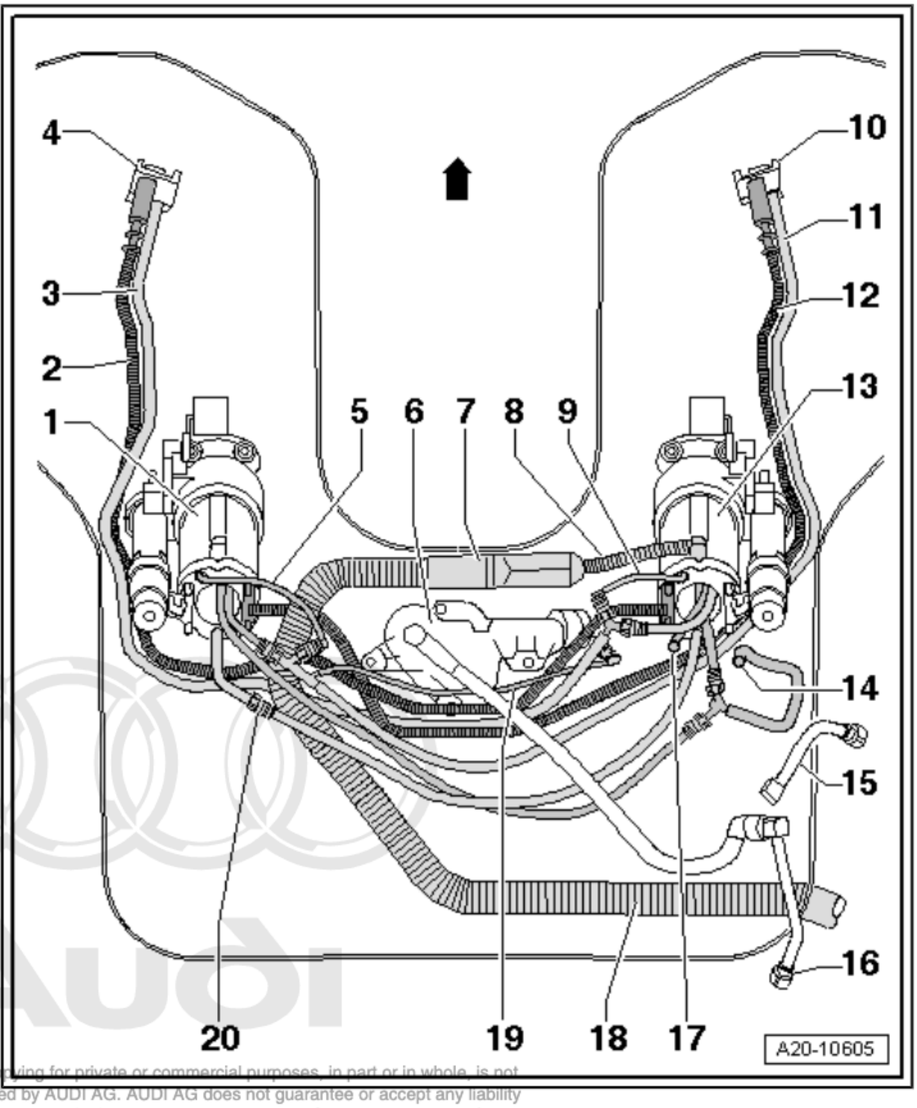
9 Routing of pipes/hoses (inside fuel tank) - USA vehicles with FSI engine

⇒ “9.1 Routing of pipes/hoses (inside fuel tank) - exploded view”, page 163

9.1 Routing of pipes/hoses (inside fuel tank) - exploded view

Note

- *The illustration shows the correct routing of pipes/hoses inside the fuel tank (schematic view).*
- *It is not necessary to route the pipes/hoses in exactly the same way as shown in the illustration, except for pipes/hoses shown in ⇒ page 164 . However it is essential to fit the pipes/hoses with sufficient space in relation to each other and to prevent rattling noises.*
- *The -arrow- points in direction of travel.*



1 - Fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

2 - Fuel supply line
- ❑ From suction-jet pump (left-side) to fuel delivery unit (right-side)

3 - Supply line for suction-jet pump
- ❑ From fuel pump (right-side) to suction-jet pump (left-side)

4 - Suction-jet pump (left-side)

5 - Supply line for suction-jet pump
- ❑ For fuel delivery unit (left-side)

6 - Expansion tank
- ❑ With suction-jet pump to extract fuel from expansion tank

7 - Non-return flap
- ❑ For fuel filler pipe

8 - Primary filler pipe
- ❑ To fuel delivery unit (right-side).
- ❑ Ensures that a small amount of fuel is delivered immediately to the fuel delivery unit when the tank is filled for the first time.

9 - Supply line for suction-jet pump
- ❑ For fuel delivery unit (right-side)

10 - Suction-jet pump (right-side)

11 - Supply line for suction-jet pump
  - ☐ From fuel pump (left-side) to suction-jet pump (right-side)

12 - Fuel supply line
  - ☐ From suction-jet pump (right-side) to fuel delivery unit (left-side)

13 - Fuel delivery unit (right-side) with fuel pump - G23-

14 - Fuel supply line
  - ☐ From fuel pumps (left and right) to flange

15 - Breather line
  - ☐ To breather connection at top of fuel filler neck

16 - Breather line
  - ☐ To activated charcoal filter at bottom of spare wheel well on underbody

17 - Fuel return line
  - ☐ From flange to fuel delivery unit (right-side)
  - ☐ Fitted loosely in fuel delivery unit (right-side)

18 - Fuel filler pipe
  - ☐ From fuel filler neck to non-return flap in fuel tank

19 - Supply line for suction-jet pump
  - ☐ To suction-jet pump in expansion tank

20 - Balance pipe
  - ☐ Between fuel delivery units

Installation position of fuel supply lines

- The fuel supply lines -1- and -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

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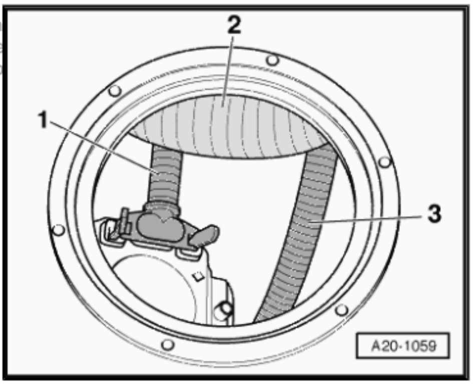


10 Fuel delivery unit with fuel pump and fuel gauge senders - USA vehicles with FSI engine

⇒ “10.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump G6 and fuel gauge senders G and G237 ”, page 165

⇒ “10.2 Checking fuel system pressurisation pump G6 (left-side) - electrical test”, page 167

⇒ “10.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump G6 ”, page 167

⇒ “10.4 Exploded view - fuel delivery unit (right-side) with fuel pump G23 and fuel gauge senders G169 and G393 ”, page 175

⇒ “10.5 Checking fuel pump G23 (right-side) - electrical test”, page 176

⇒ “10.6 Removing and installing fuel delivery unit (right-side) with fuel pump G23 ”, page 177

⇒ “10.7 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine”, page 185

⇒ “10.8 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)”, page 189

⇒ “10.9 Fuel pump control unit J538 ”, page 193

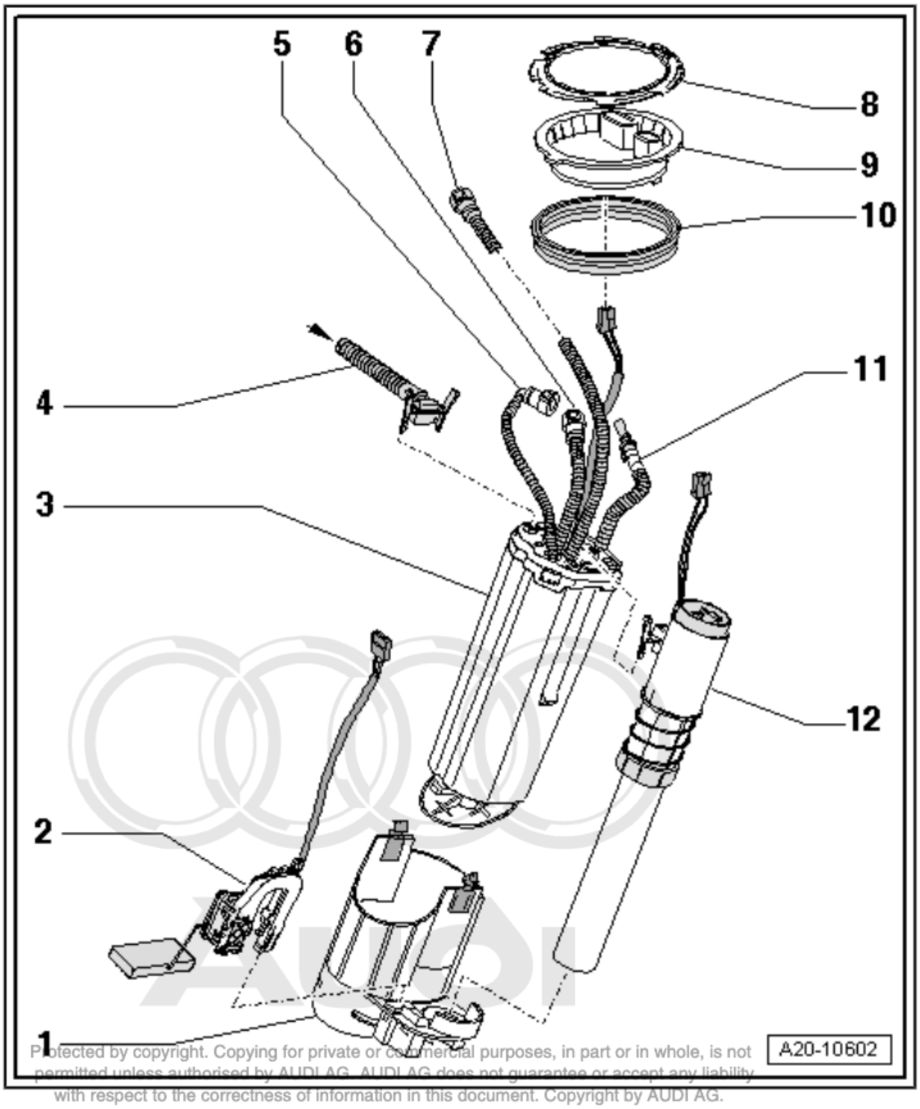
⇒ “10.10 Removing and installing fuel pump control unit J538 ”, page 193

⇒ “10.11 Suction-jet pumps”, page 194

⇒ “10.12 Removing and installing suction-jet pump (left-side)”, page 196

⇒ “10.13 Removing and installing suction-jet pump (right-side)”, page 198

10.1 Exploded view - fuel delivery unit (left-side) with fuel system pressurisation pump - G6- and fuel gauge senders G and -G237-



1 - Retainer
- ☐ For fuel delivery unit

2 - Fuel gauge sender - G-
- ☐ Black
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 221
- ☐ Removing and installing ⇒ page 222

3 - Fuel delivery unit (left-side)
- ☐ With fuel system pressurisation pump - G6-
- ☐ Clipped onto retainer -item 1-
- ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ☐ Checking fuel pump (electrical test) ⇒ page 125
- ☐ Checking residual pressure ⇒ Rep. gr. 24
- ☐ Removing and installing ⇒ page 70
- ☐ Put at least 5 litres of fuel into tank after installing

4 - Fuel supply line
- ☐ From suction jet pump (right-side)
- ☐ Clipped onto fuel delivery unit -item 3-

5 - Supply line for suction-jet pump
- ☐ For fuel delivery unit (left-side)

6 - Supply line for suction-jet pump
- ☐ To suction-jet pump (right-side)

7 - Fuel supply line
- ☐ The plug connector is located on the right side of the fuel tank
- ☐ Press release tab on connection piece to disconnect

8 - Locking ring
- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

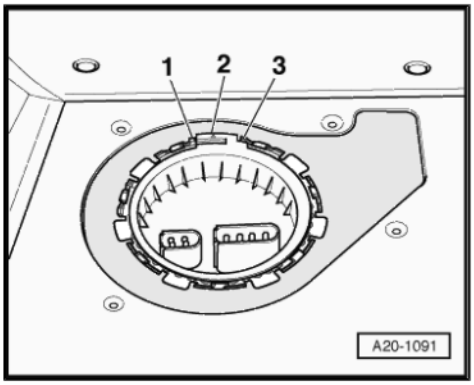
9 - Flange (left-side)
- ☐ Installation position ⇒ page 167

10 - Seal
- ☐ Renew
- ☐ Install dry

11 - Balance pipe
- ☐ To fuel delivery unit (right-side).

12 - Fuel gauge sender 3 - G237-

- ☐ Grey
- ☐ Clipped onto fuel delivery unit -item 3-
- ☐ Checking resistance values ⇒ page 225
- ☐ Removing and installing ⇒ page 226



Installation position of flange (left-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

10.2 Checking fuel system pressurisation pump - G6- (left-side) - electrical test

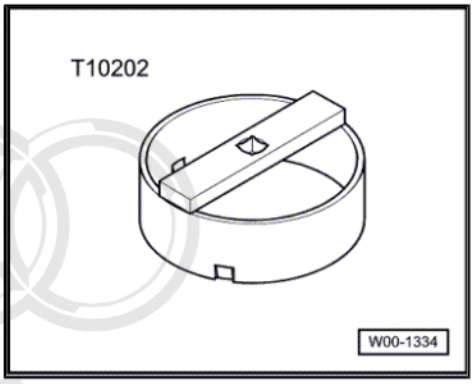
◆ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .

◆ Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

10.3 Removing and installing fuel delivery unit (left-side) with fuel system pressurisation pump - G6-

Special tools and workshop equipment required

◆ Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

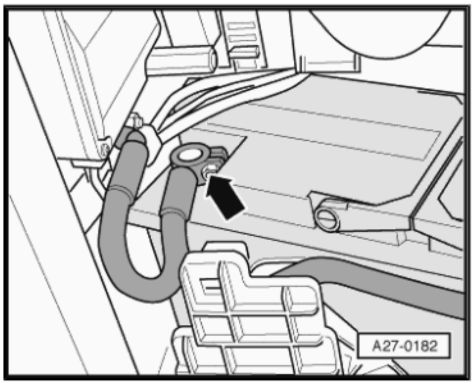
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

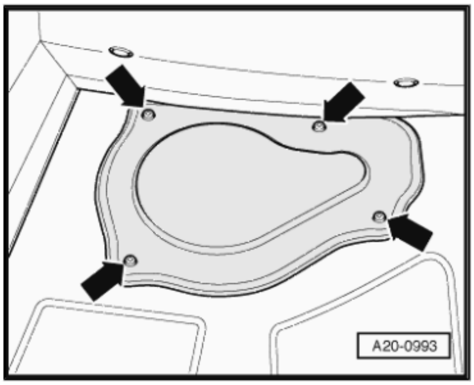


- Remove luggage compartment floor covering.

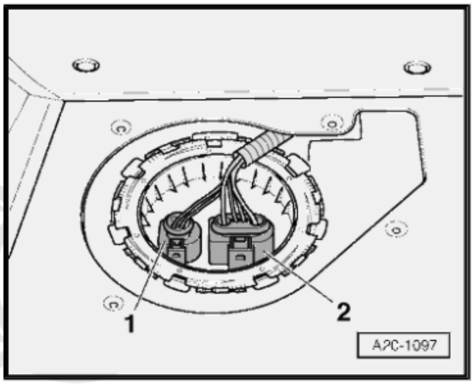
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

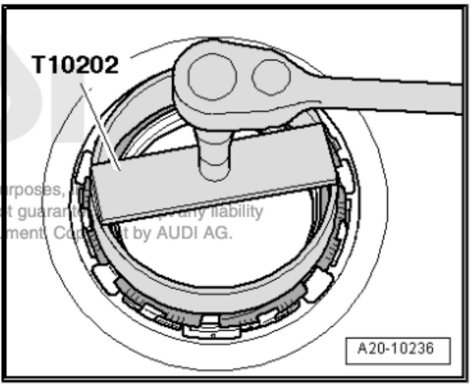
- Detach cover for flange (left-side) -arrows-.



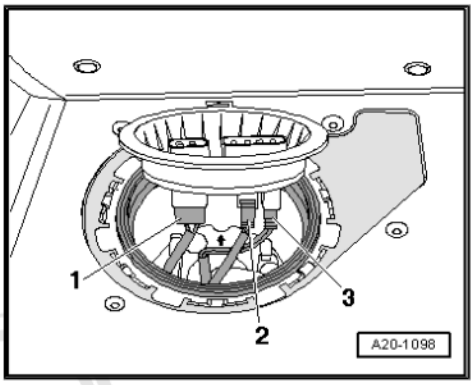
- Unplug electrical connectors -1- and -2- on flange (left-side).



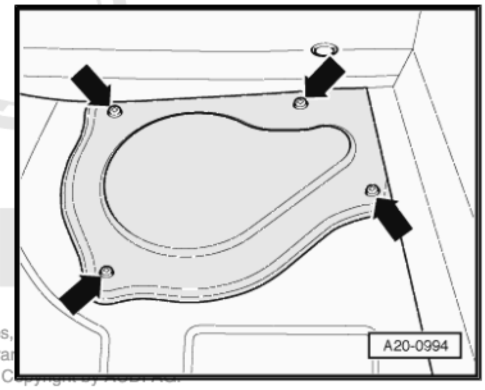
- Unscrew locking ring using wrench - T10202- .



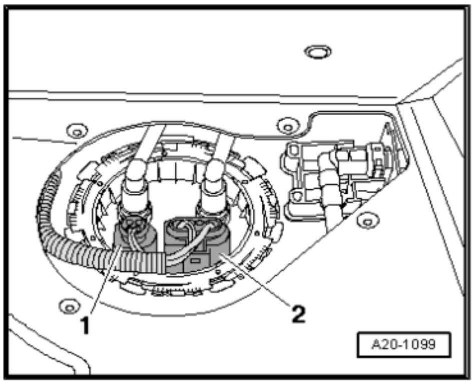
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (right-side).

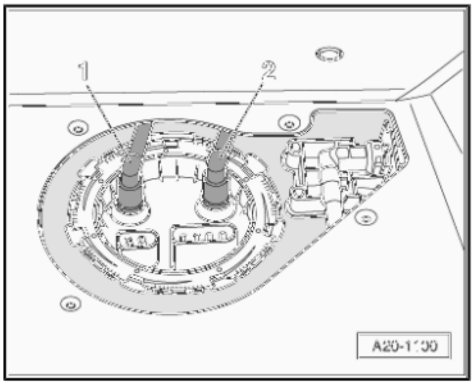


- Mark fuel return line -1- and fuel supply line -2-.

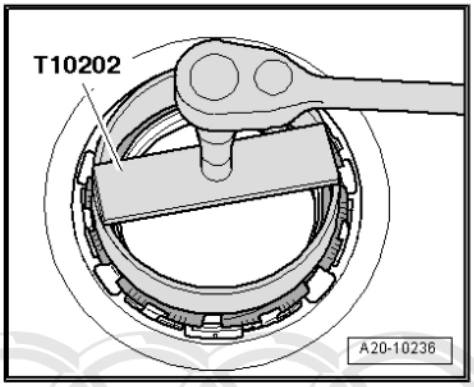
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

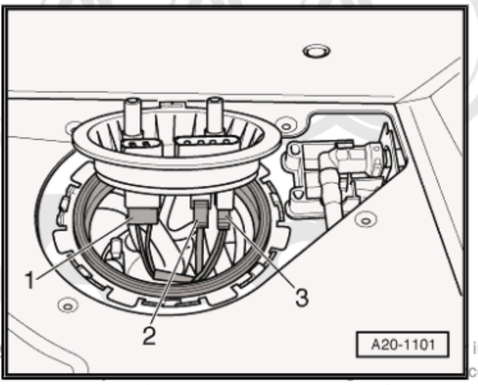
- Detach both lines from flange (press release tabs).



- Unscrew locking ring using wrench - T10202- .



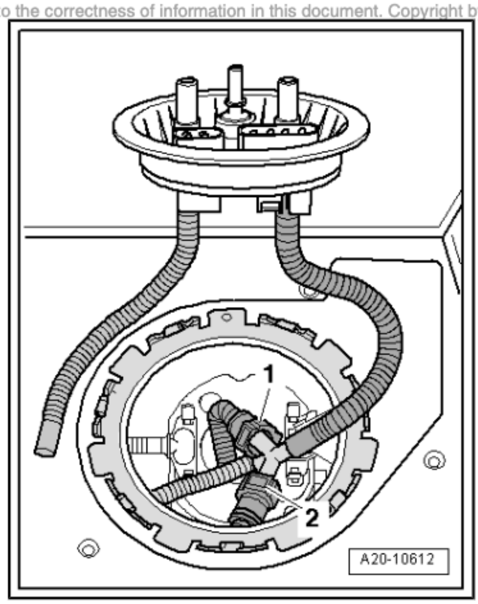
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

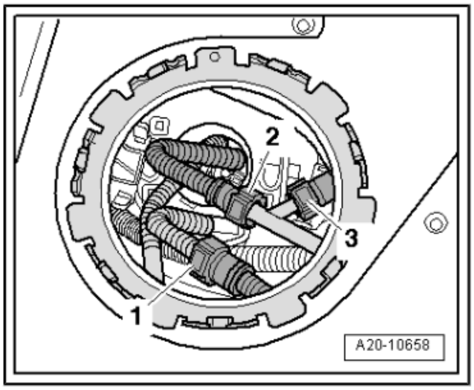
- Working through right fuel tank opening, press release tab and disconnect fuel supply line -2- going to fuel delivery unit (left-side).



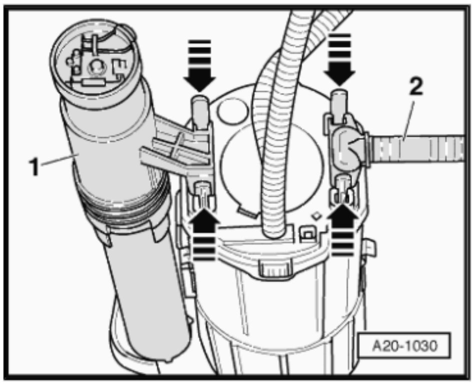
Note

Disregard -item 1-.

- Working through left fuel tank opening, press release tabs and disconnect balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side).
- Pull disconnected fuel lines out of left fuel tank opening.



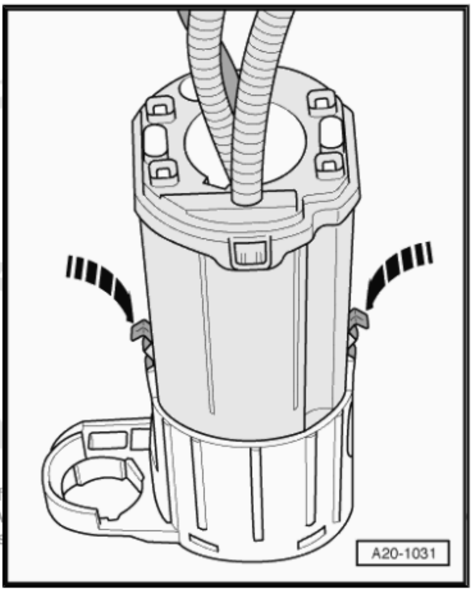
- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

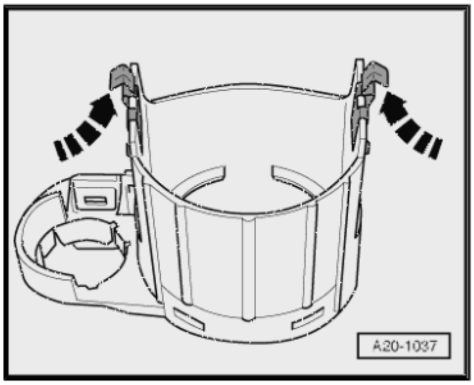
Note

Keep in mind that the fuel delivery unit still contains fuel.

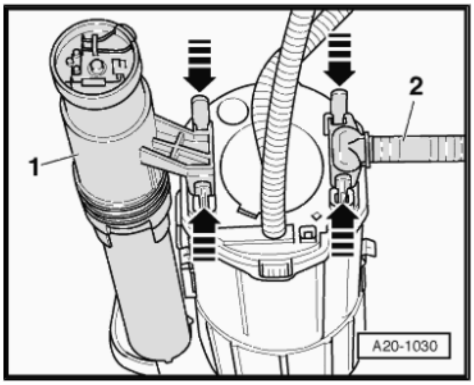


Installing

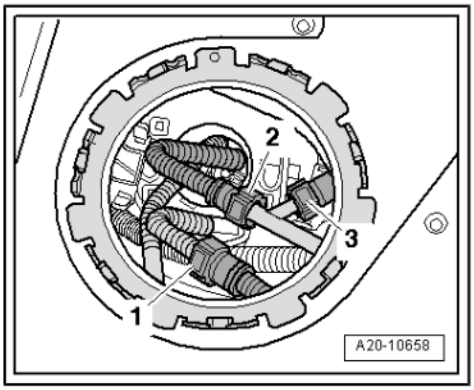
- Tightening torque ⇒ page 68
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.
- Guide fuel supply line for fuel delivery unit (left-side) into fuel tank chamber (right-side).



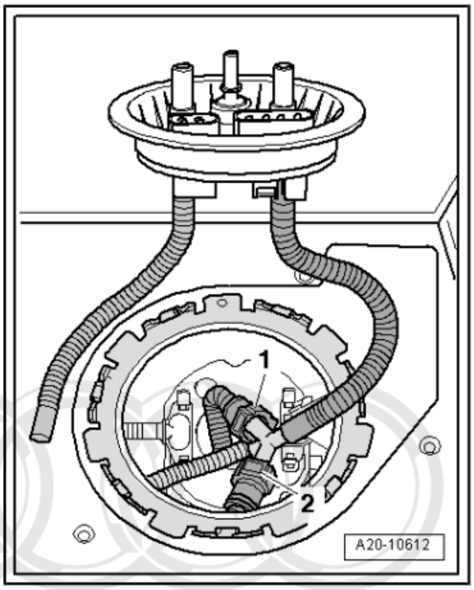
– Working through left fuel tank opening, fit balance pipe -1- and supply line -2- going to suction-jet pump (right-side) and supply line -3- going to fuel delivery unit (left-side) so that they engage audibly.



– Working through right fuel tank opening, fit fuel supply line -2- so that it engages audibly.

Note

Disregard -item 1-.



– Connect electrical connectors -1 ... 3- on underside of flange (right-side).

– Install new seal for flange (seal must be installed dry).

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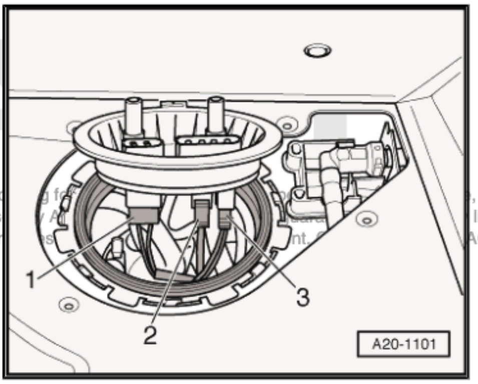
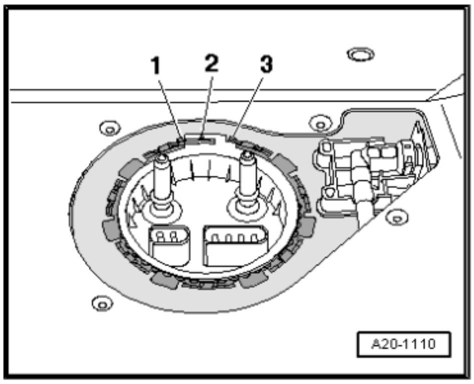
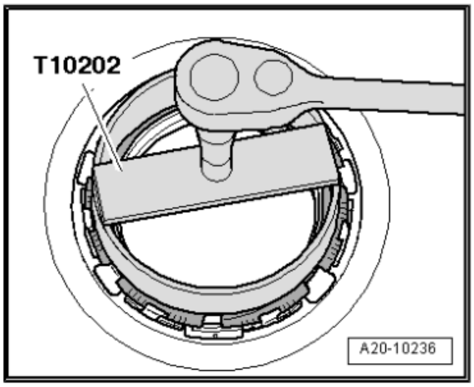


– Fit flange into fuel tank; note correct installation position:

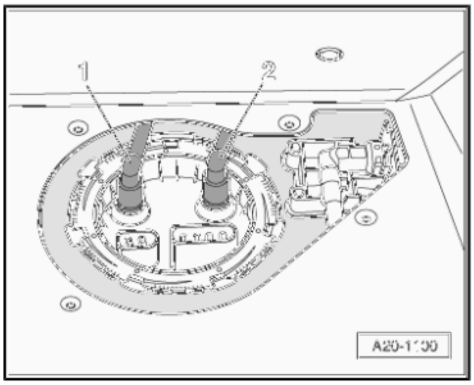
- The hose for the return line must be guided into the opening in the centre of the fuel delivery unit.
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



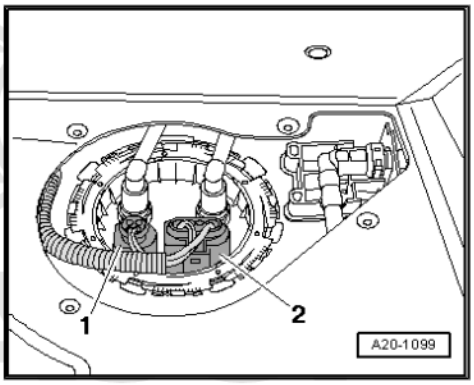
- Tighten locking ring.



- Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



- Attach electrical connectors -1- and -2- on flange (right-side).



- Secure cover for flange (right-side) -arrows-.

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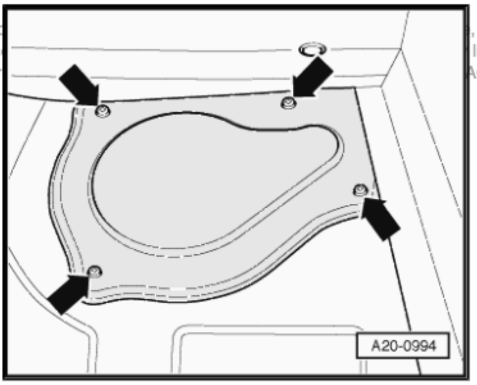
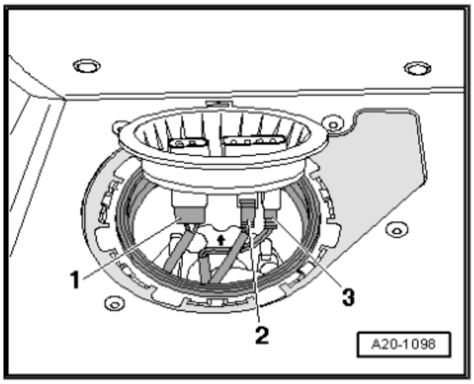


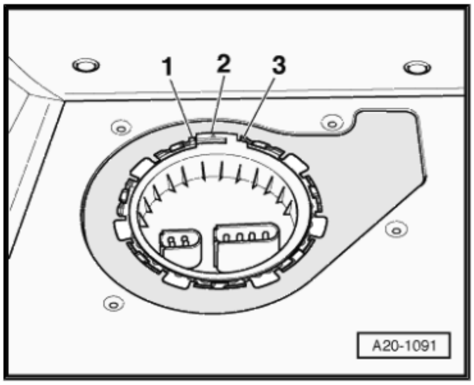
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

– Install new seal for flange (seal must be installed dry).

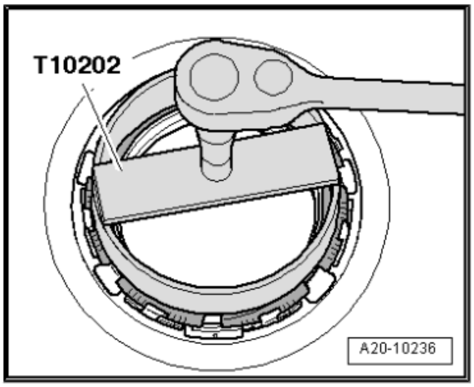


– Fit flange into fuel tank; note correct installation position:

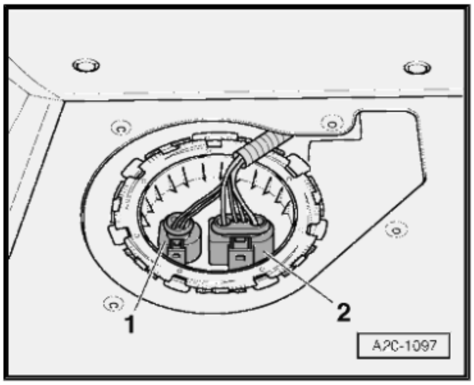
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

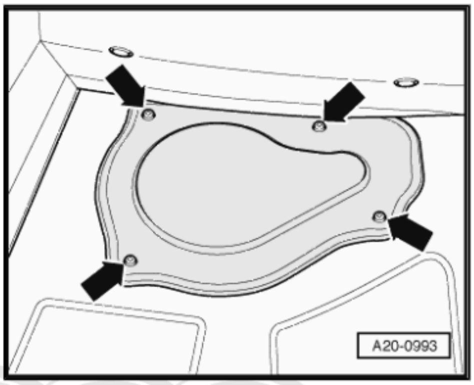


– Tighten locking ring.



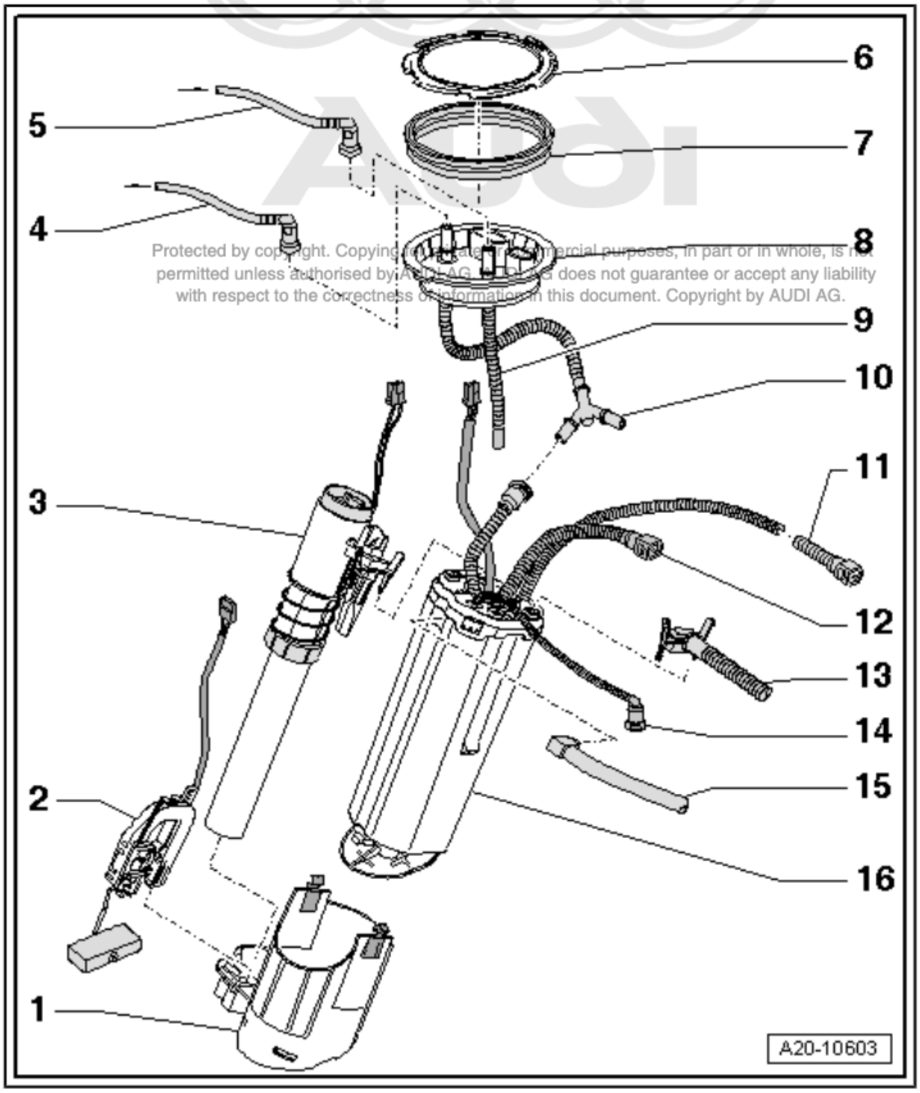
– Attach electrical connectors -1- and -2- on flange (left-side).





- Secure cover for flange (left-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .
- Put at least 5 litres of fuel into tank after installing

10.4 Exploded view - fuel delivery unit (right-side) with fuel pump - G23- and fuel gauge senders -G169- and -G393-



1 - Retainer

- ☐ For fuel delivery unit

2 - Fuel gauge sender 2 - G169-

- ☐ Yellow
- ☐ Clipped onto retainer -item 1-
- ☐ Checking resistance values ⇒ page 223
- ☐ Removing and installing ⇒ page 224

3 - Fuel gauge sender 4 - G393-

- ☐ White
- ☐ Clipped onto fuel delivery unit -item 16-
- ☐ Checking resistance values ⇒ page 230
- ☐ Removing and installing ⇒ page 232

4 - Fuel supply line

- ☐ To fuel filter
- ☐ Mark before removing
- ☐ Press release tab on connection piece to disconnect
- ☐ Do not kink
- ☐ Clip onto fuel tank

5 - Fuel return line

- ☐ From fuel rail
- ☐ Mark before removing
- ☐ Press release tab on connection piece to disconnect
- ☐ Do not kink
- ☐ Clip onto fuel tank

6 - Locking ring

- ☐ Remove and install using wrench - T10202-
- ☐ Tighten to 120 Nm

7 - Seal

- ☐ Renew
- ☐ Install dry

8 - Flange (right-side)

- ☐ Installation position ⇒ page 176

9 - Fuel return line

- ☐ From flange to fuel delivery unit (right-side)
- ☐ Fitted loosely in fuel delivery unit (right-side)

10 - Fuel supply line

- ☐ From fuel delivery units to flange

11 - Balance pipe

- ☐ Between fuel delivery units

12 - Supply line for suction-jet pump

- ☐ For suction-jet pump
- ☐ Press release tab on connection piece to disconnect

13 - Fuel supply line

- ☐ From suction-jet pump (left-side)
- ☐ Clipped onto fuel delivery unit -item 16-

14 - Supply line for suction-jet pump

- ☐ For fuel delivery unit (right-side)

15 - Fuel filler pipe

- ☐ From filler neck
- ☐ Clipped onto fuel delivery unit -item 16-

16 - Fuel delivery unit (right-side)

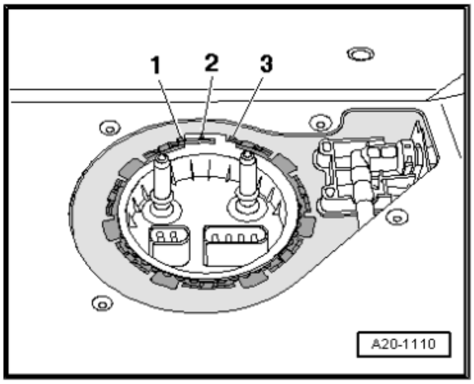
- ☐ With fuel pump - G23-
- ☐ Clipped onto retainer -item 1-
- ☐ Different versions available; for correct version refer to ⇒ Electronic parts catalogue
- ☐ Checking fuel pump (electrical test) ⇒ page 81
- ☐ Checking residual pressure ⇒ Rep. gr. 24
- ☐ Removing and installing ⇒ page 81
- ☐ Put at least 5 litres of fuel into tank after installing

Installation position of flange (right-side)

– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



10.5 Checking fuel pump - G23- (right-side) - electrical test

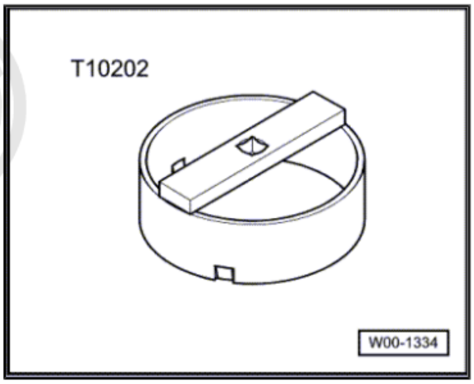
◆ On vehicles with FSI engine, voltage for the fuel pumps is supplied via fuel pump control unit - J538- .

- Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

10.6 Removing and installing fuel delivery unit (right-side) with fuel pump - G23-

Special tools and workshop equipment required

- Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

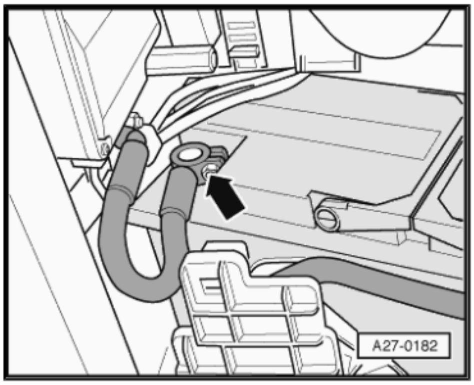
Caution

- *The fuel tank must not be more than $^1/_3$ full when removing the fuel delivery unit. Drain the tank if necessary. Procedure ⇒ page 112*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

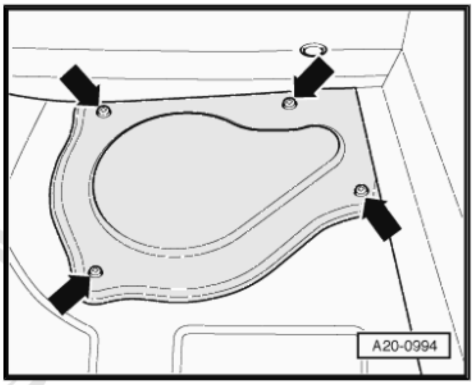


– Remove luggage compartment floor covering.

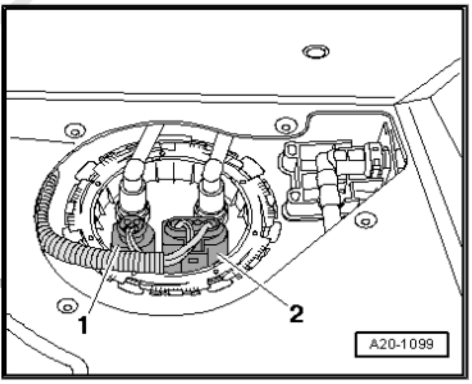
Note

For removing and installing fuel delivery unit, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Unscrew cover for flange (right-side) -arrows-.



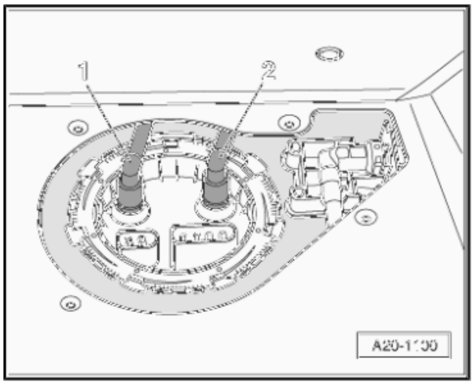
– Unplug electrical connectors -1- and -2- on flange (right-side).



– Mark fuel return line -1- and fuel supply line -2-.

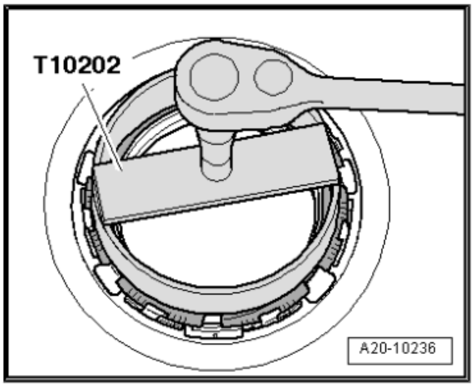
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

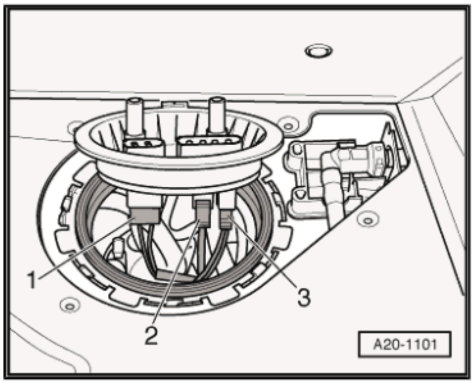


– Detach both lines from flange (press release tabs).

– Unscrew locking ring using wrench - T10202- .



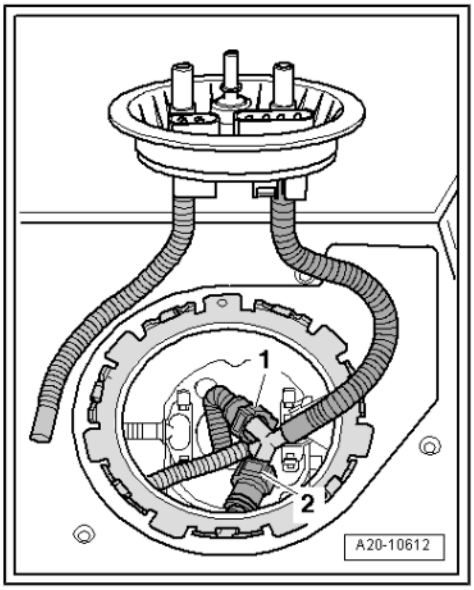
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



Note

Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.

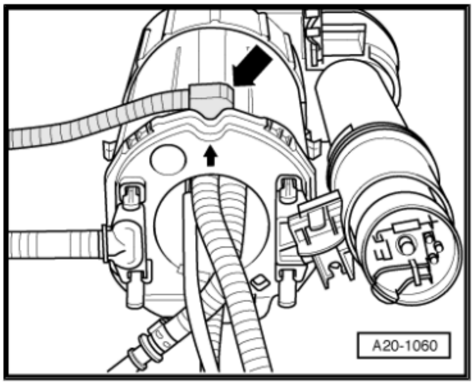
- Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



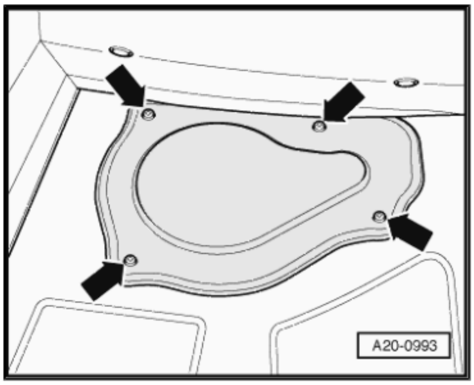
Note

For illustration purposes some of the components are shown removed in the following illustrations.

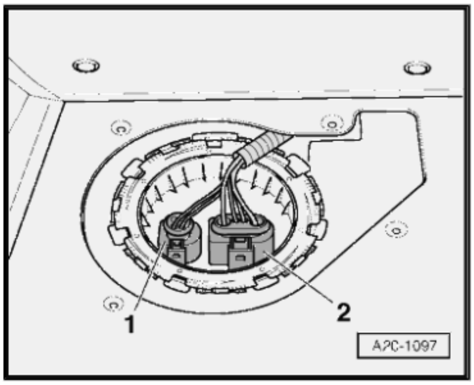
- Unclip fuel filler pipe -arrow- at front of fuel delivery unit (right-side).



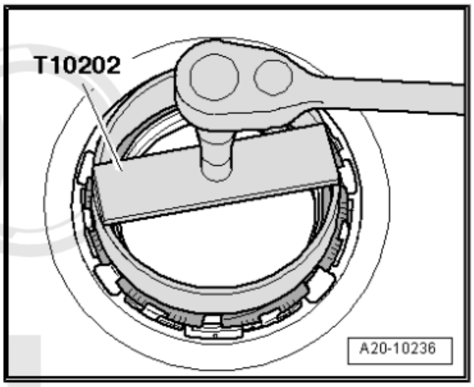
- Detach cover for flange (left-side) -arrows-.



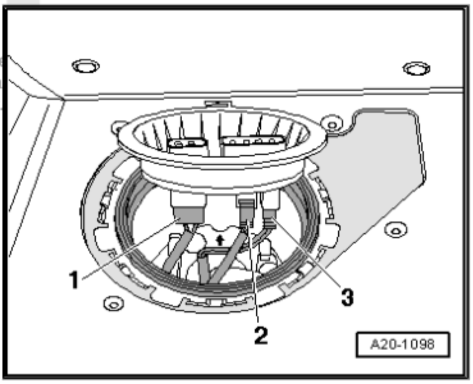
- Unplug electrical connectors -1- and -2- on flange (left-side).



- Unscrew locking ring using wrench - T10202- .



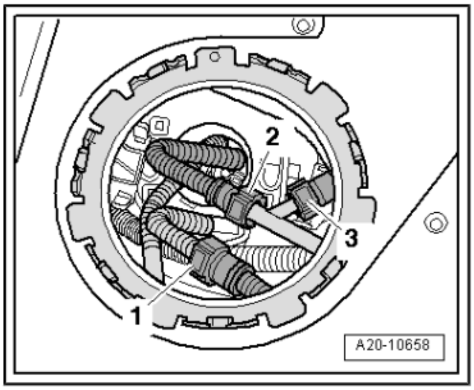
- Detach flange and remove seal.
- Unplug electrical connectors -1- ... 3- on underside of flange (left-side).



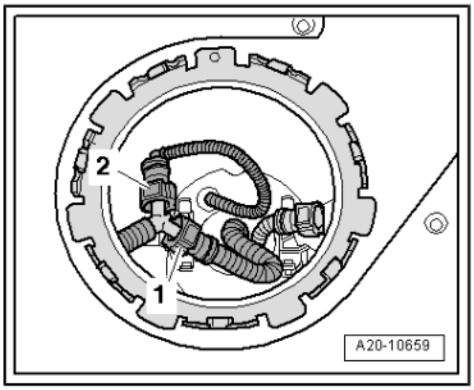
- Working through left fuel tank opening, press release tab and disconnect connecting pipe -1-.
- Pull out connecting pipe from right fuel tank opening.

Note

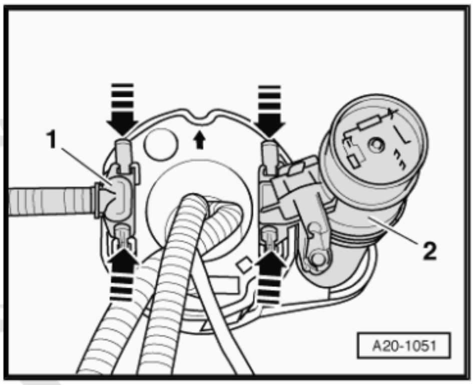
Disregard -items 2, 3-.



- Working through right fuel tank opening, press release tabs and disconnect supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side).



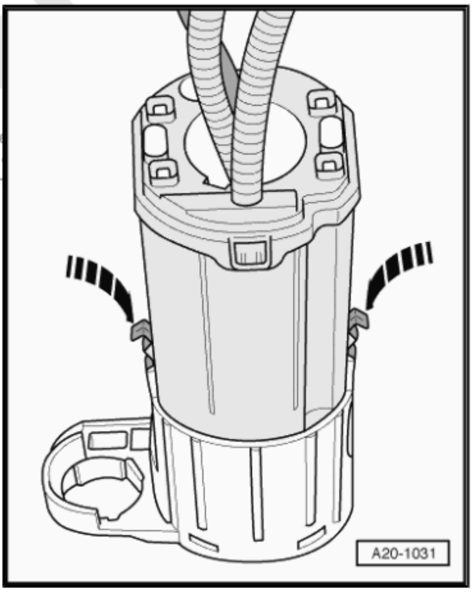
- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Remove fuel delivery unit.

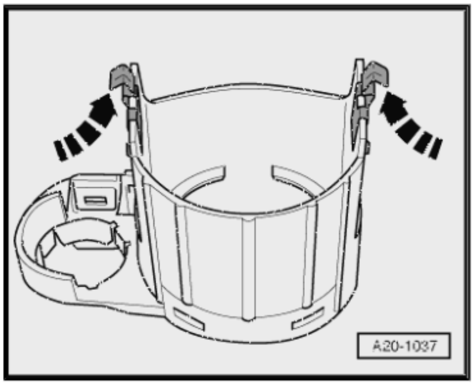
Note

Keep in mind that the fuel delivery unit still contains fuel.

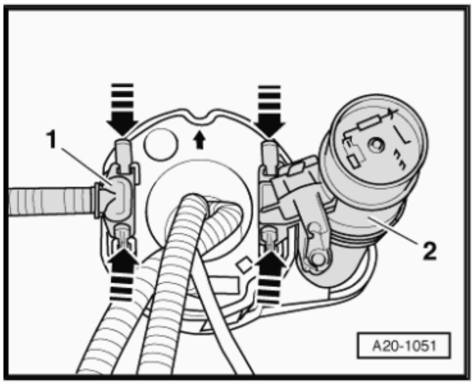


Installing

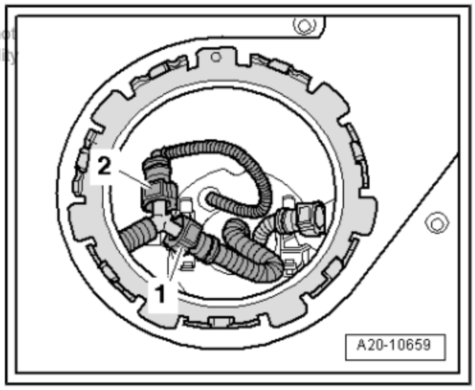
- Tightening torque ⇒ page 79
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



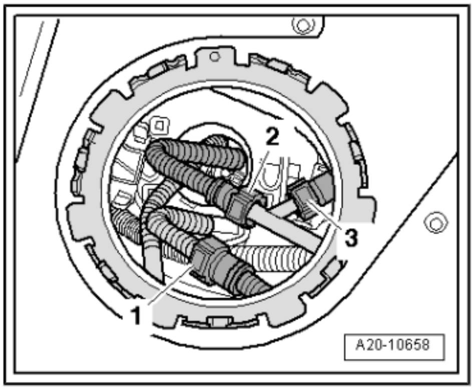
– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly on fuel delivery unit (right-side).



– Working through right fuel tank opening, fit supply line -1- going to suction-jet pump (left-side) and supply line -2- going to fuel delivery unit (right-side) so that they engage audibly.

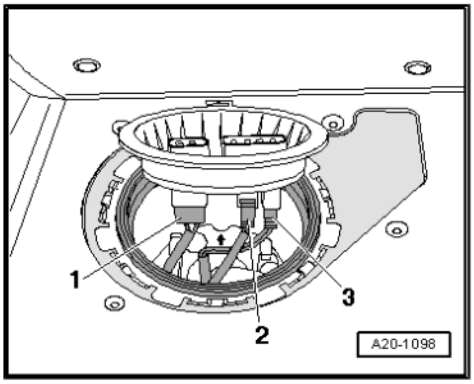


– Fit connecting pipe -1- through left opening on fuel tank so that it engages audibly.



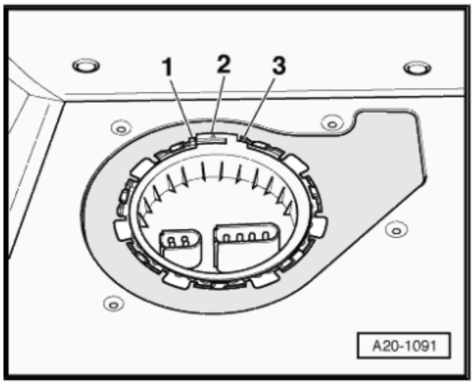
– Connect electrical connectors -1 ... 3- on underside of flange (left-side).

– Install new seal for flange (seal must be installed dry).

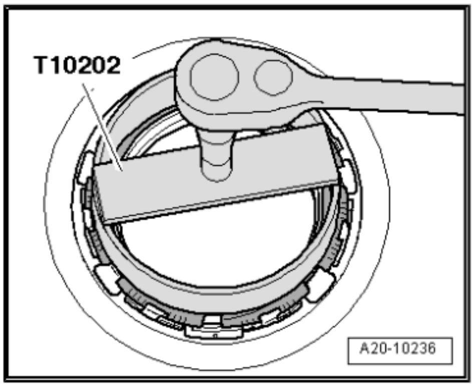


- Fit flange into fuel tank; note correct installation position:

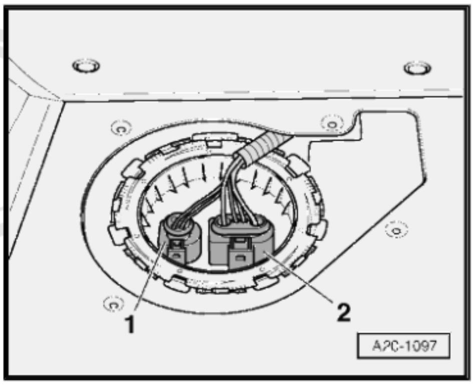
• Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



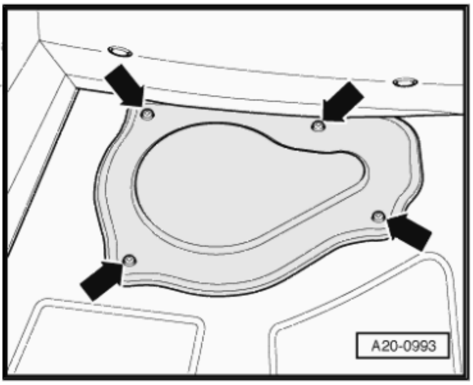
- Tighten locking ring.



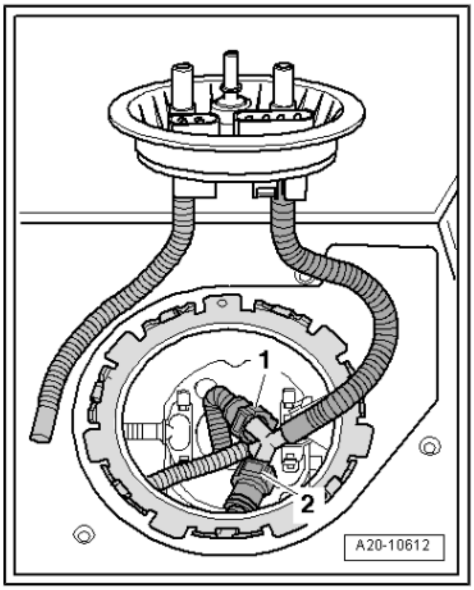
- Attach electrical connectors -1- and -2- on flange (left-side).



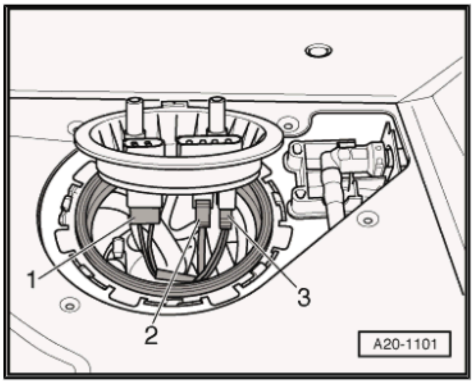
- Secure cover for flange (left-side) -arrows-.



- Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.

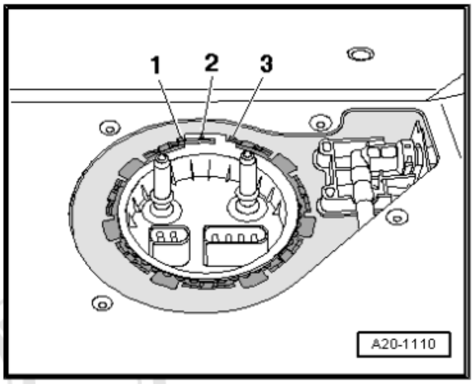


- Connect electrical connectors -1 ... 3- on underside of flange (right-side).
- Install new seal for flange (seal must be installed dry).

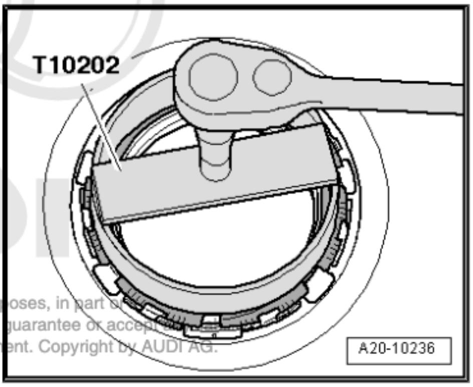


- Fit flange into fuel tank; note correct installation position:

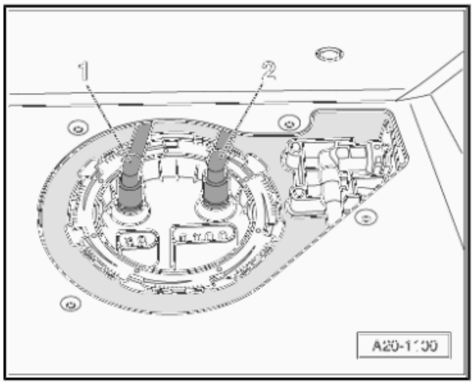
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



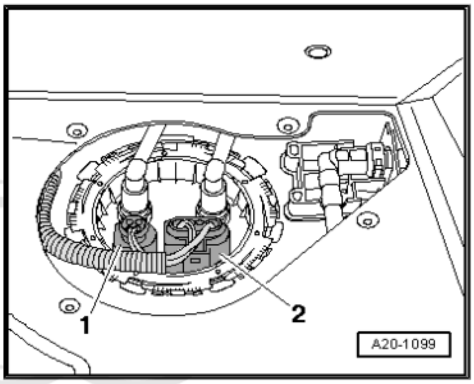
- Tighten locking ring.



– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.



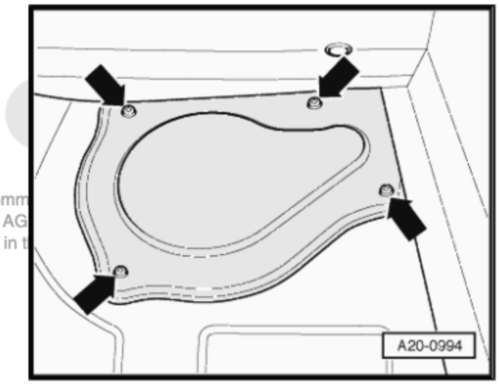
– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

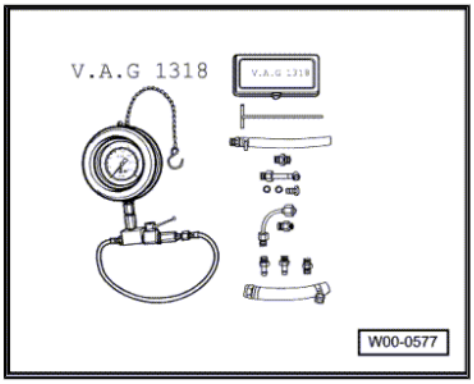
– Put at least 5 litres of fuel into tank after installing



10.7 Checking delivery rate of fuel pumps - vehicles with 8-cylinder engine

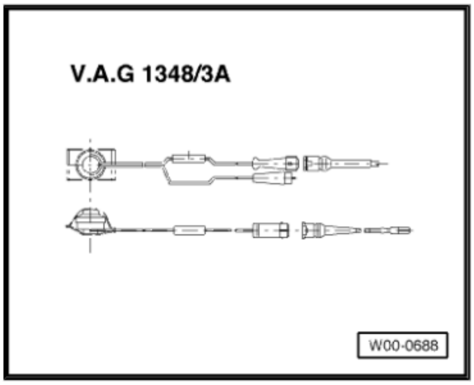
Special tools and workshop equipment required

- ♦ K-Jetronic pressure tester - V.A.G 1318-



- ♦ Adapter set - V.A.G 1318/10-12-

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



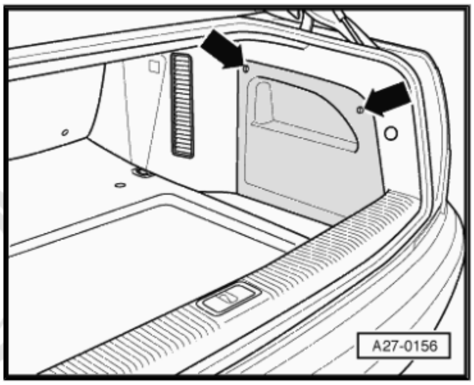
- Fuel-resistant measuring container

Procedure

– Observe test conditions ⇒ page 3 .

WARNING

Observe safety precautions ⇒ page 1 .



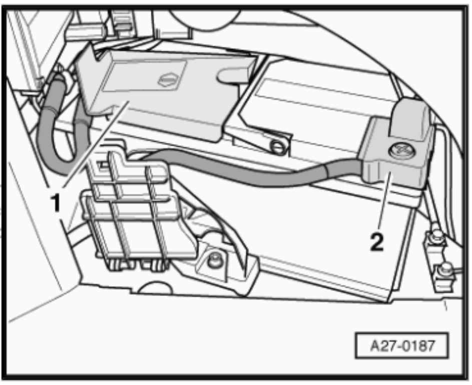
– Remove luggage compartment side trim cover (right-side) -arrows-.

– Remove cover -2- over battery.

Note

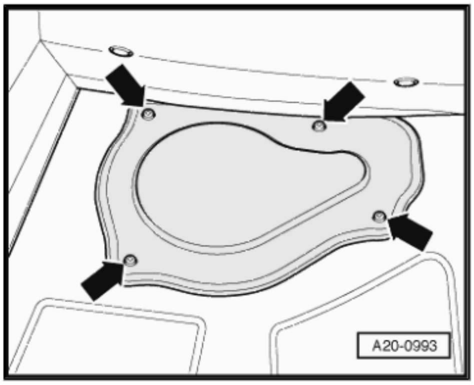
Disregard -item 1-.

Audi



– Remove luggage compartment floor covering.

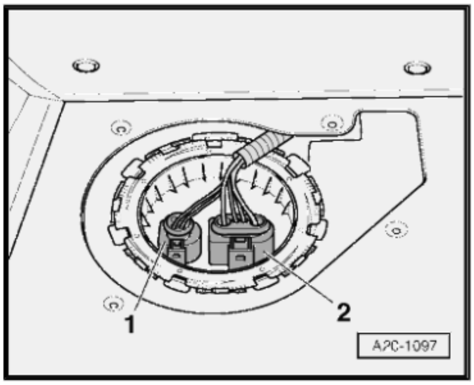
– Detach cover for flange (left-side) -arrows-.



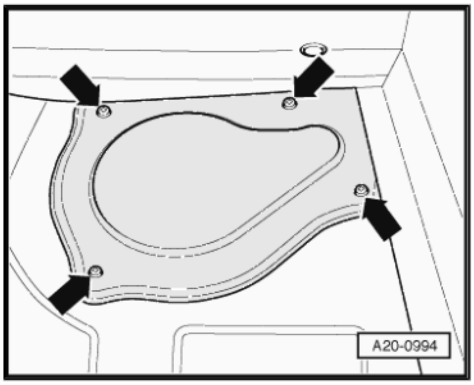
- Unplug electrical connector -2- on flange (left-side).

Note

Disregard -item 1-.



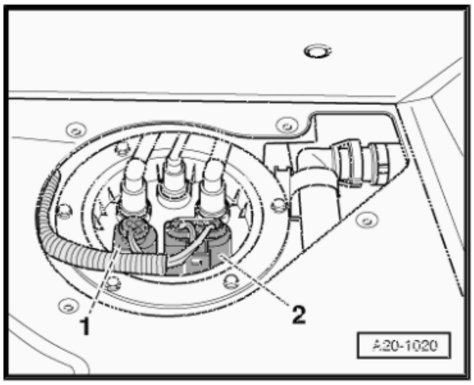
- Unscrew cover for flange (right-side) -arrows-.



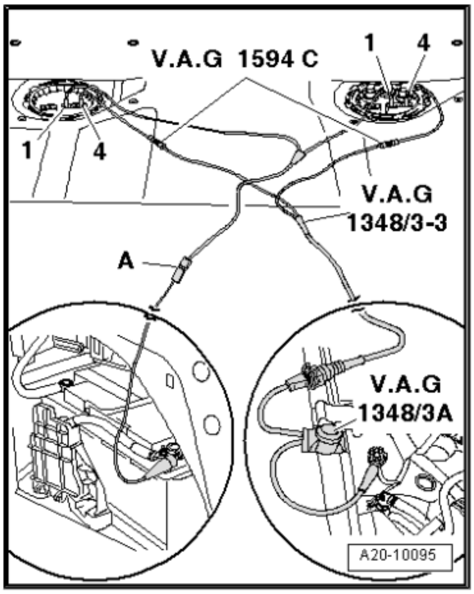
- Unplug electrical connector -2- on flange (right-side).

Note

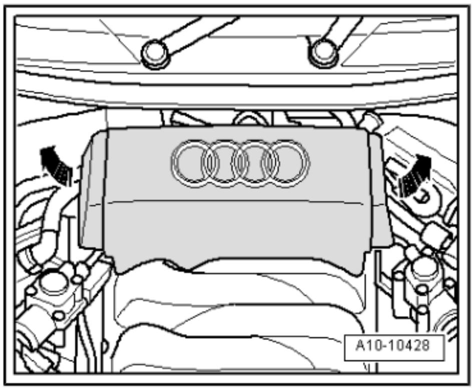
Disregard -item 1-.



- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
- Connect crocodile clip to earth point in engine compartment.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery "+" via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.

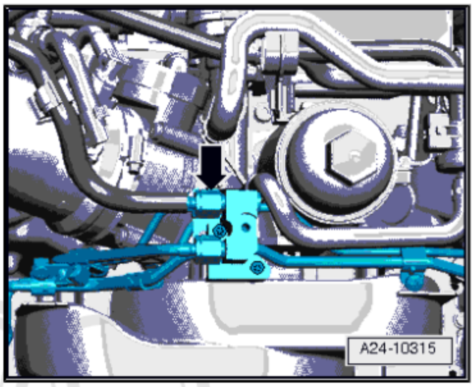


- Pull off engine cover panel (rear) -arrows-.



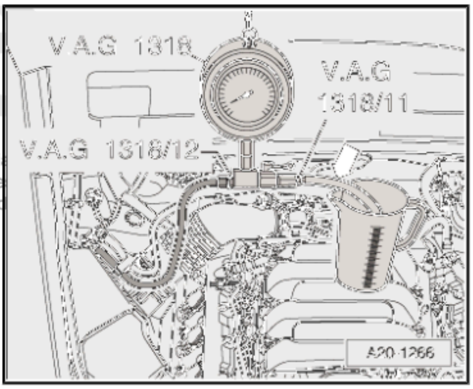
> **WARNING**
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*

- Disconnect fuel supply line -arrow- at connecting piece.



> **Caution**
>
> *Rules for cleanliness when working on the injection system ⇒ page 3 .*

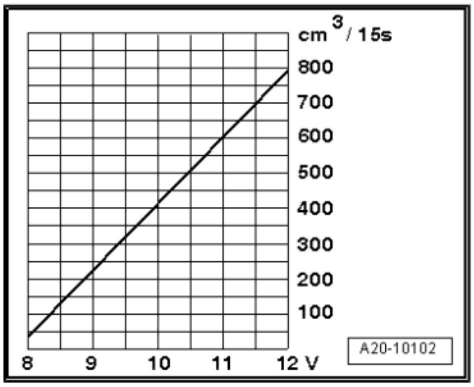
- Disconnect fuel line -arrow-.



- Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.
- Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.
- Open cut-off valve on pressure tester. Lever must point in direction of flow.

- Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.
- Specification: 4 bar
- From this point on do not move position of cut-off valve.
- Empty the measuring container.

- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

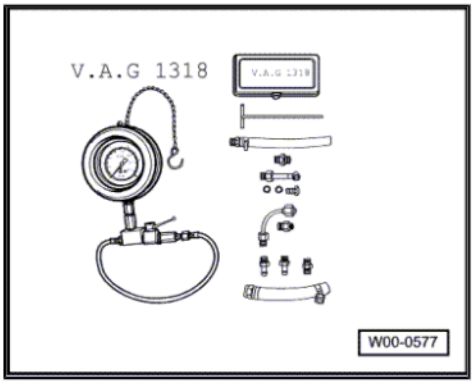
Installation is carried out in the reverse order; note the following:

- Secure fuel line to engine ⇒ Rep. gr. 24 .

10.8 Checking delivery rate of fuel pumps - vehicles with 10-cylinder engine (Audi S8)

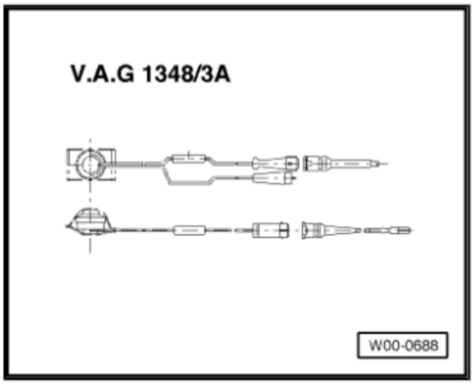
Special tools and workshop equipment required

- K-Jetronic pressure tester - V.A.G 1318-



- Adapter set - V.A.G 1318/10-12-

- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-



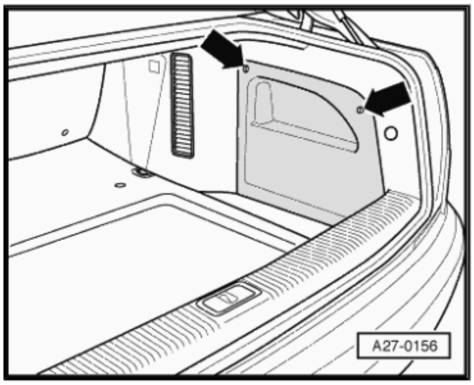
- Fuel-resistant measuring container

Procedure

– Observe test conditions ⇒ page 3 .

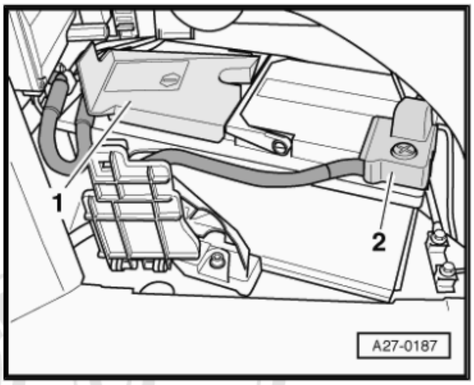
WARNING

Observe safety precautions ⇒ page 1 .



– Remove luggage compartment side trim cover (right-side) -arrows-.

– Remove cover -2- over battery.

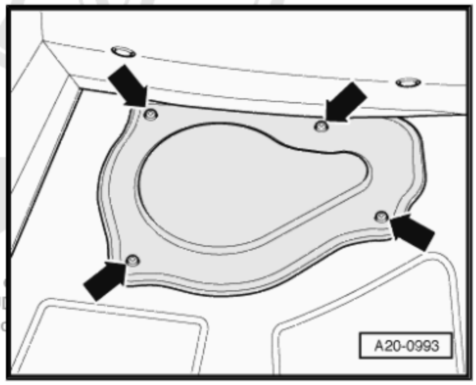


Note

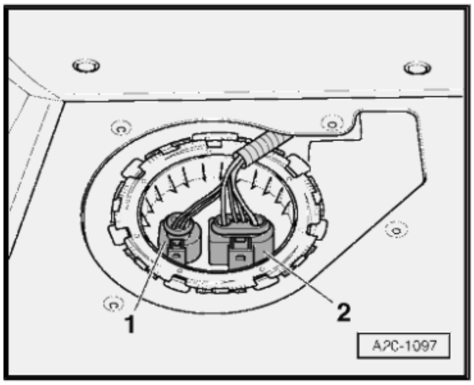
Disregard -item 1-.

– Remove luggage compartment floor covering.

– Detach cover for flange (left-side) -arrows-.



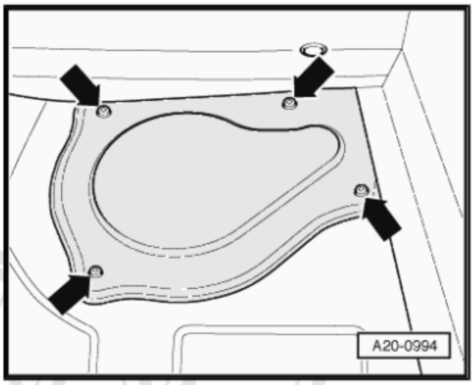
- Unplug electrical connector -2- on flange (left-side).



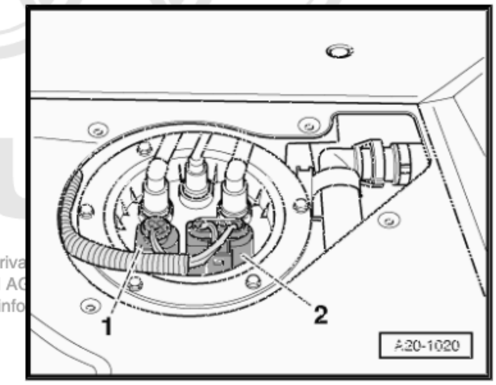
Note

Disregard -item 1-.

- Unscrew cover for flange (right-side) -arrows-.



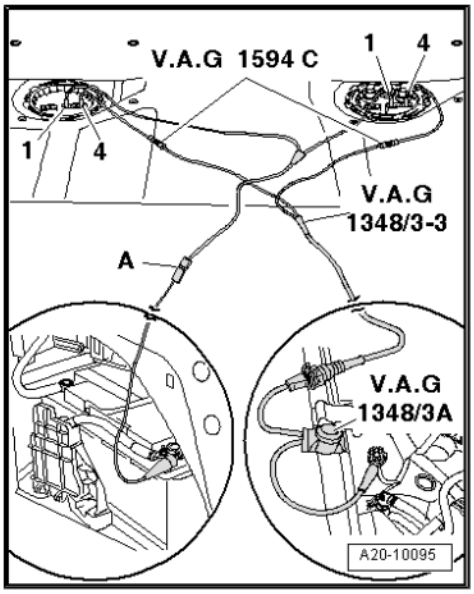
- Unplug electrical connector -2- on flange (right-side).



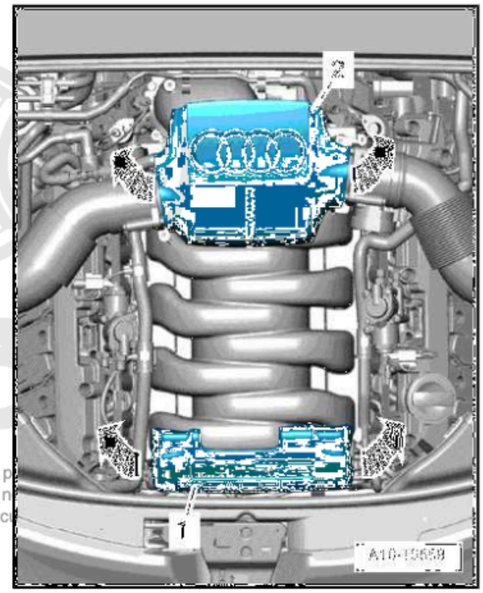
Note

Disregard -item 1-.

- Connect remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3- to contact -4- (earth) of fuel delivery unit (left-side) and fuel delivery unit (right-side) using test leads from auxiliary measuring set - V.A.G 1594C- .
- Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.
- Connect crocodile clip to earth point in engine compartment.
- Connect contact -1- (positive) of fuel delivery unit (left-side) and fuel delivery unit (right-side) to battery "+" via an improvised test lead. For safety reasons an in-line fuse -A- (10 A) must be connected into the lead.
- Remove filler cap from fuel filler neck.



– Pull off engine cover panel (rear) -2- -arrows-.

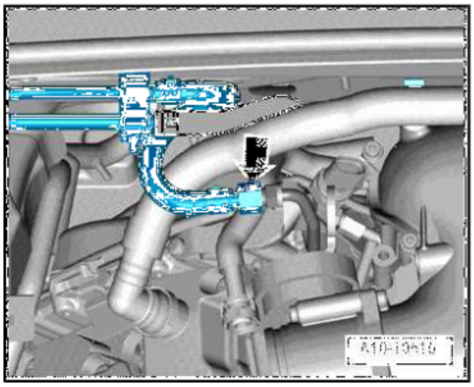


Note

Disregard -item 1-.

WARNING

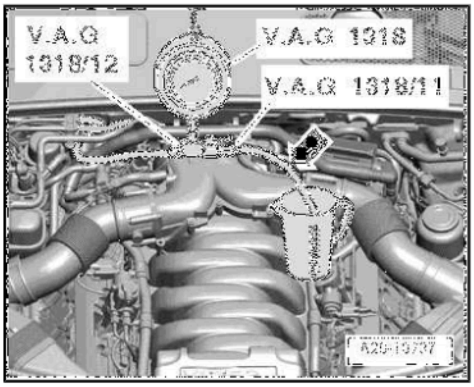
The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.



Caution

Rules for cleanliness when working on the injection system ⇒ page 3 .

– Disconnect fuel pipe -arrow- at fuel rail.



– Connect K-Jetronic pressure tester - V.A.G 1318- with adapters - V.A.G 1318/11- and -V.A.G 1318/12- to fuel line.

– Fit auxiliary hose -arrow- onto pressure tester and hold it in a measuring container.

– Open cut-off valve on pressure tester. Lever must point in direction of flow.

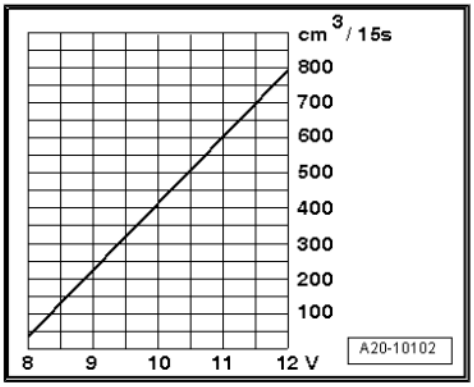
– Build up pressure in fuel system by pressing the remote control button and slowly closing the cut-off valve on the pressure tester.

- Specification: 4 bar

– From this point on do not move position of cut-off valve.

– Empty the measuring container.

- Press remote control button for 15 seconds.
- Compare amount of fuel delivered with minimum delivery shown in diagram (cm^3/15 sec.).



Note

Voltage at fuel pump with engine stationary and pump running is approx. 2 volts less than battery voltage.

If minimum delivery rate is not reached, check for the following causes:

- Fuel lines have been crushed.
- Fuel filter is blocked.
- Fuel pump is defective.

Note

As there is hardly any difference in the fuel delivery rate if only one of the two fuel pumps is working (because of the hose connections inside the tank), it is difficult to diagnose a defective pump by just measuring the delivery rate.

In this case proceed as follows:

- Unplug the electrical auxiliary lead at the fuel delivery units (one at a time).
- Measure delivery rate of fuel delivery unit located on the opposite side.

If the delivery rate of the fuel delivery unit which has been measured separately is considerably below specification:

- Renew the relevant fuel delivery unit.

Installation is carried out in the reverse order; note the following:

- Secure fuel line to fuel rail ⇒ Rep. gr. 24 .

10.9 Fuel pump control unit - J538-

Check fuel pump control unit - J538- in “Guided Fault Finding” ⇒ Vehicle diagnostic tester.

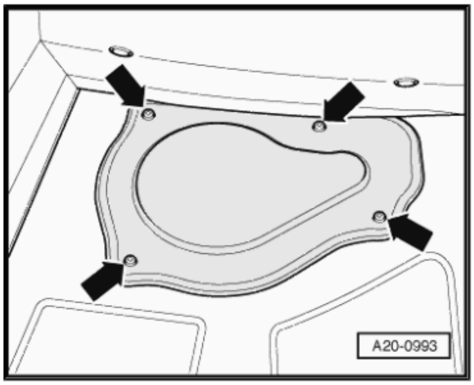
10.10 Removing and installing fuel pump control unit - J538-

Removing

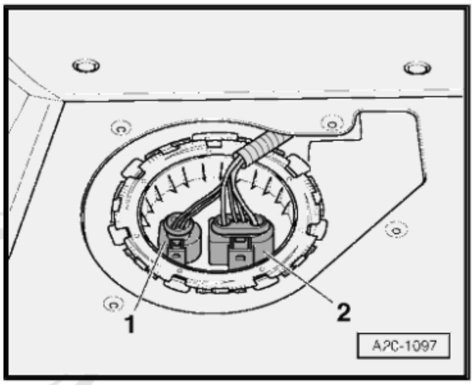
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

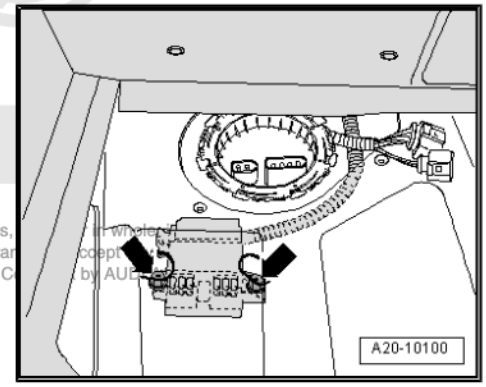
- Switch off ignition and remove ignition key.
- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (left-side).



- Remove plugs in luggage compartment floor and unscrew nuts -arrows-.
- Slightly lift floor panel in the area of flange by hand and remove fuel pump control unit - J538- between floor panel and fuel tank flange.
- Unplug electrical connector at control unit.



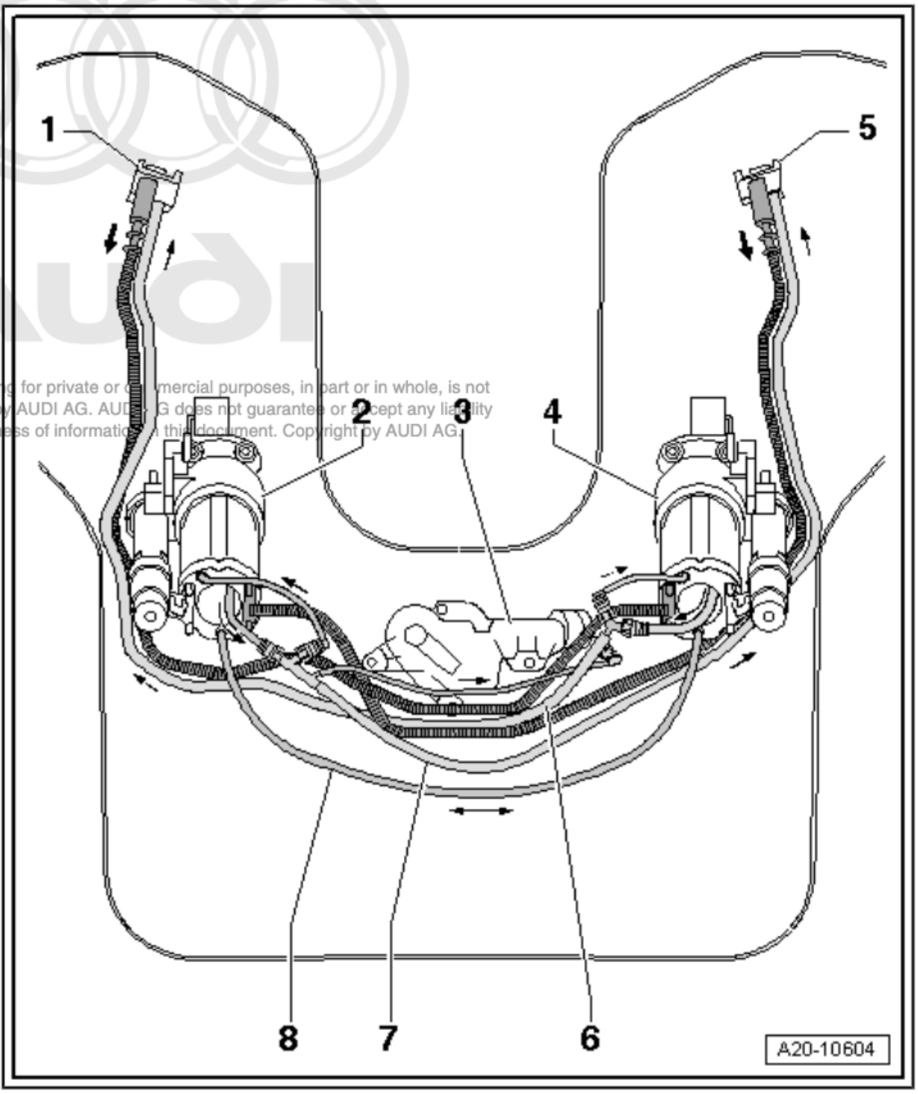
Installing

Install in reverse order.

Tightening torque

Component	Nm
Fuel pump control unit - J538- to fuel tank	1.6

10.11 Suction-jet pumps



1 - Suction-jet pump (left-side)

2 - Fuel delivery unit (left-side)

3 - Expansion tank

4 - Fuel delivery unit (right-side)

5 - Suction-jet pump (right-side)

6 - Supply line for suction-jet pump

  ☐ From fuel delivery unit (right-side) to suction-jet pump (left-side)

7 - Supply line for suction-jet pump

  ☐ From fuel delivery unit (left-side) to suction-jet pump (right-side)

8 - Balance pipe

  ☐ Between fuel delivery units

Description of operation
To ensure a reliable fuel supply in all situations, the fuel pumps must never draw in air, even under extreme driving conditions such as very sharp bends or under heavy braking. This may happen when the fuel sloshes into one of the corners of a partially filled fuel tank.

- ♦ For this reason, the fuel delivery units -item 2- and -item 4- incorporate a so-called baffle housing, in which the fuel pumps are fitted, as well as the fuel pumps themselves. The baffle housing is a container permanently filled with fuel, so that the fuel pumps are surrounded with fuel regardless of the fuel level in the tank.
- ♦ Consequently, proper filling of the baffle housings is essential for trouble-free operation of the fuel pumps. This is the purpose of the "suction-jet pumps".
- ♦ The suction-jet pumps operate according to the principle of fluid entrainment: a stream of fuel from the primary stage of the fuel pumps -2- (left-side) and -4- (right-side) is fed via the supply lines -6- and -7- to the suction-jet pumps -1- and -5-, where it is passed through a nozzle and thus accelerated. The accelerated stream of fuel draws off the surrounding fuel and delivers it to the baffle housings in the fuel delivery units. The suction jet pump (right-side) -item 5- delivers the fuel into the baffle housing (left-side); the suction jet pump (left-side) -item 1- delivers the fuel into the baffle housing (right-side).
- ♦ In addition, the stream of fuel from the fuel pumps is supplied to the two smaller suction-jet pumps in the baffle housings via two Y-connectors. Working through the balance pipe -item 8-, these ensure that the baffle housings in both fuel delivery units are filled evenly.
- ♦ Another small suction-jet pump is located in the expansion tank -item 3- and delivers fuel from there back to the fuel tank.

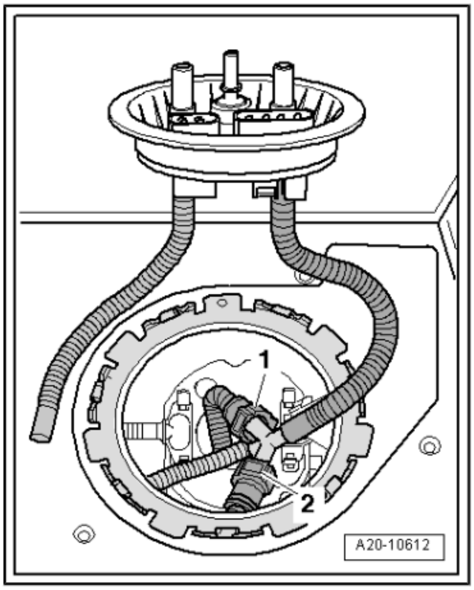
10.12 Removing and installing suction-jet pump (left-side)

Removing

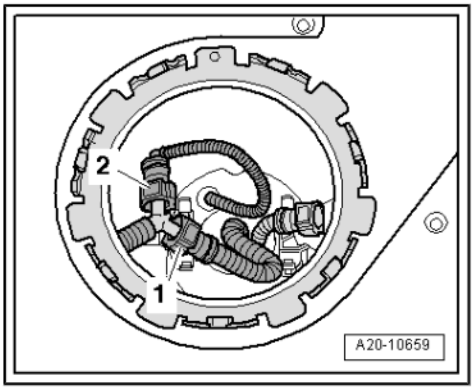
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

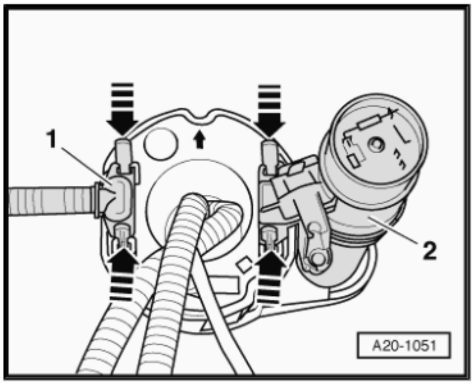
- Remove the fuel delivery unit (left-side) ⇒ page 26 .
- Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.
- Working through right fuel tank opening, press release tab and disconnect fuel supply line -1-.
- Detach flange.



- Working through right fuel tank opening, press release tabs and disconnect supply lines -1- and -2- for suction-jet pumps from Y-connector.



- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1-.

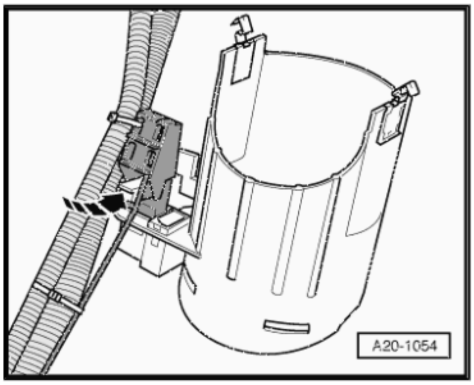


Note

Disregard -item 2-.

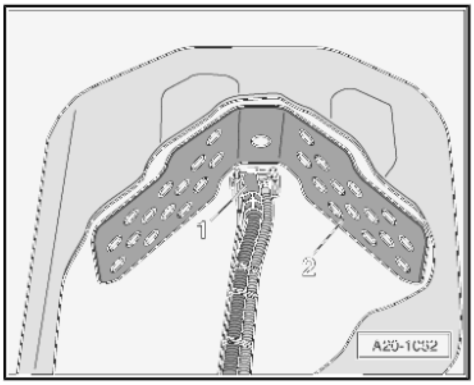
- Pull out disconnected fuel supply line through left fuel tank opening.

- Working through left fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull out suction-jet pump (left-side) together with lines through left fuel tank opening.



Installing

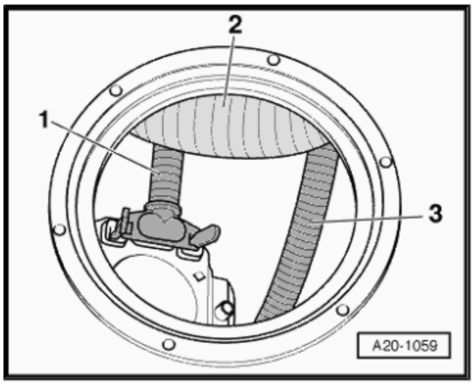
- Version with baffle plate: insert suction-jet pump (left-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.



- Push fuel supply line through left fuel tank opening into right fuel tank chamber. Note routing:
- The fuel supply line -3- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

Note

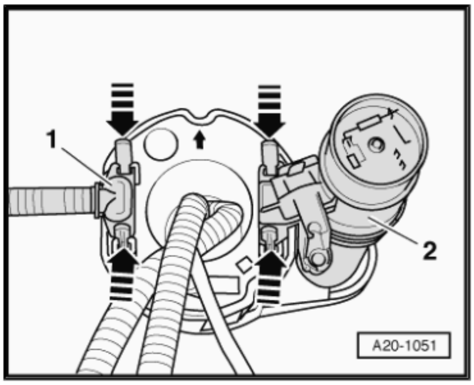
Disregard -item 1-.



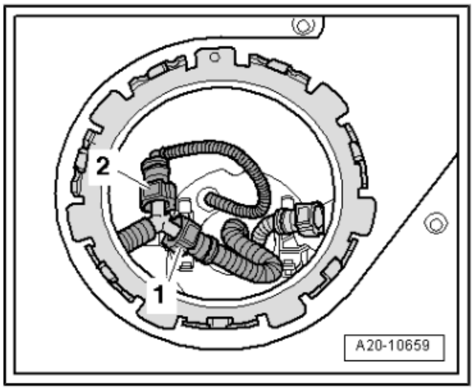
- Fit fuel supply line -1- onto fuel delivery unit (right-side) so that it engages audibly.

Note

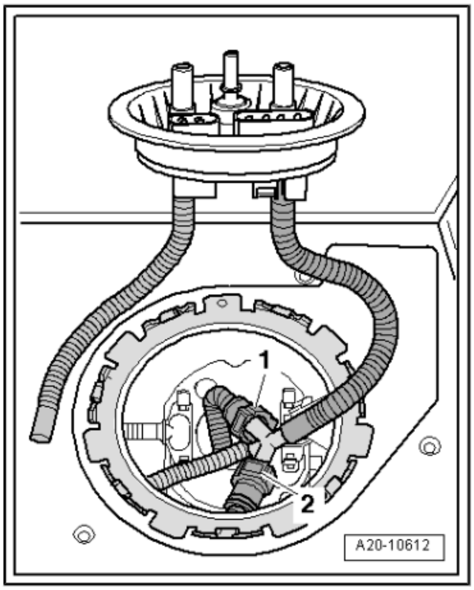
Disregard -item 2-.



- Working through right fuel tank opening, fit supply lines -1- and -2- for suction-jet pumps onto Y-connector so that they engage audibly.



- Working through right fuel tank opening, fit fuel supply line -1- so that it engages audibly.
- Insert fuel gauge sender 3 - G237- into fuel tank.
- Install fuel delivery unit (left-side) ⇒ page 31 .



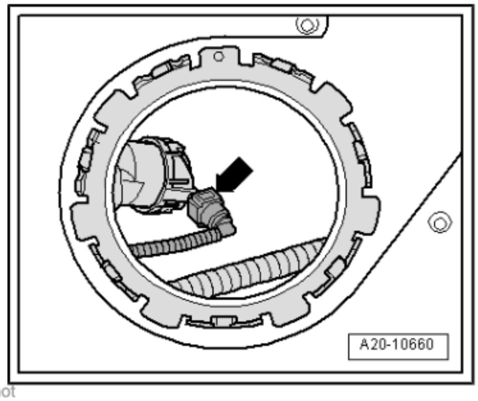
10.13 Removing and installing suction-jet pump (right-side)

Removing

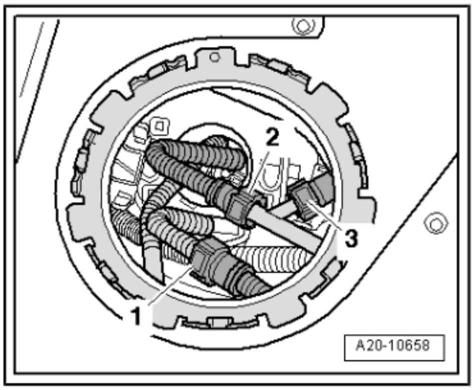
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

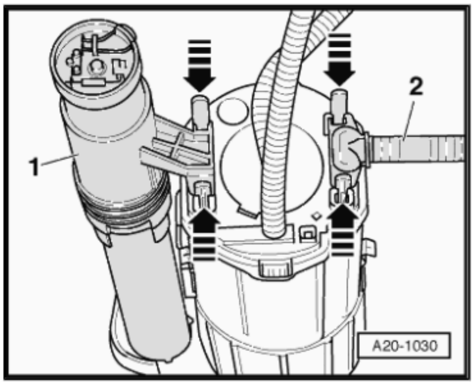
- Remove fuel delivery unit (right-side) ⇒ page 42 .
- Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.
- Working through right fuel tank opening, press release tab and disconnect supply line for suction-jet pump -arrow- from expansion tank.



- Working through left fuel tank opening, press release tabs and disconnect supply lines -2- and -3- for suction-jet pumps from Y-connector.



- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2-.

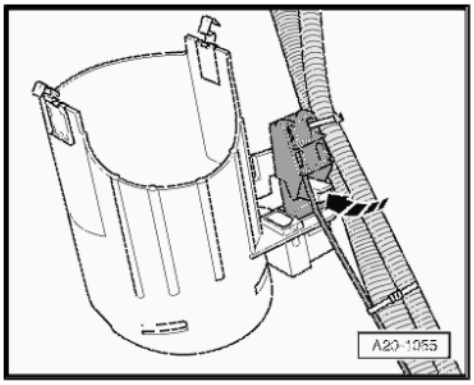


Note

Disregard -item 1-.

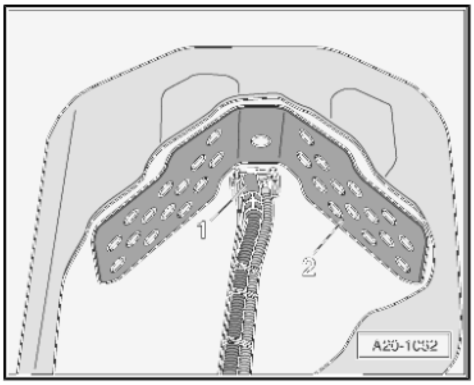
- Pull out disconnected fuel supply line through right fuel tank opening.

- Working through right fuel tank opening, press release tab -arrow- and detach retaining clip for suction jet lines from retainer.
- Pull suction-jet pump (right-side) together with lines out of right fuel tank opening.



Installing

- Version with baffle plate: insert suction-jet pump (right-side) -1- so it fits in recess in baffle plate -2- at front of fuel tank, as shown in illustration.
- Then press retaining clip for suction-jet pump into retainer so it engages audibly.

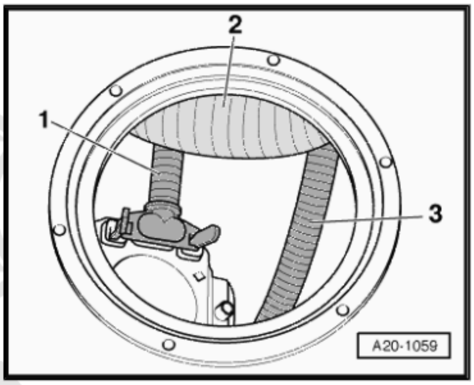


- Push fuel supply line through right fuel tank opening into left fuel tank chamber. Note routing:

- The fuel supply line -1- must be routed below the fuel filler pipe -2- at the left fuel tank opening.

Note

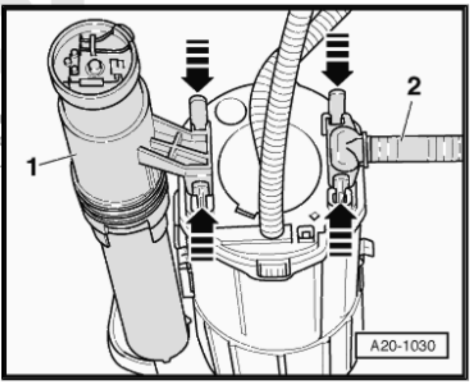
Disregard -item 3-.



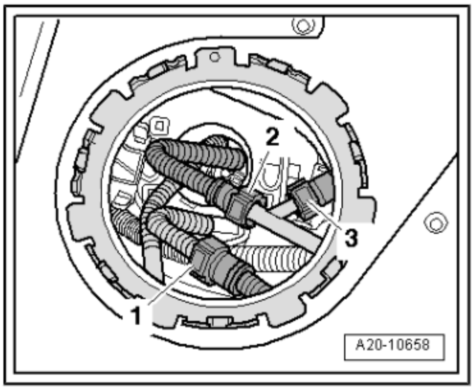
- Fit fuel supply line -2- onto fuel delivery unit (left-side) so that it engages audibly.

Note

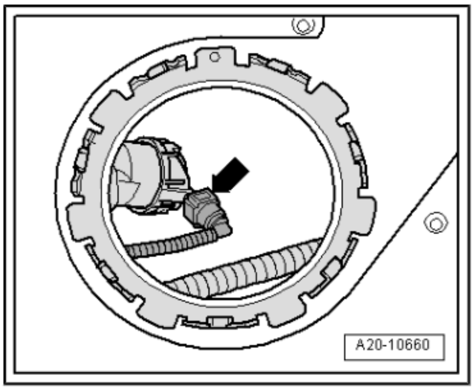
Disregard -item 1-.



- Push supply line for suction-jet pump through right fuel tank opening into left fuel tank chamber.
- Working through left fuel tank opening, fit supply lines -2- and -3- for suction-jet pumps onto Y-connector so that they engage audibly.



- Working through right fuel tank opening, fit supply line for suction-jet pump -arrow- onto connection on expansion tank so that it engages audibly.
- Insert fuel gauge sender 4 - G393- into fuel tank.
- Install fuel delivery unit (right-side) ⇒ page 48 .



11 Fuel gauge senders - rest-of-world vehicles

⇒ “11.1 Checking fuel gauge sender G (lever-type sender, left-side)”, page 201

⇒ “11.2 Removing and installing fuel gauge sender G (lever-type sender, left-side)”, page 202

⇒ “11.3 Checking fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 203

⇒ “11.4 Removing and installing fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 204

⇒ “11.5 Checking fuel gauge sender 3 G237 (tubular sender, left-side)”, page 205

⇒ “11.6 Removing and installing fuel gauge sender 3 G237 (tubular sender, left-side)”, page 206

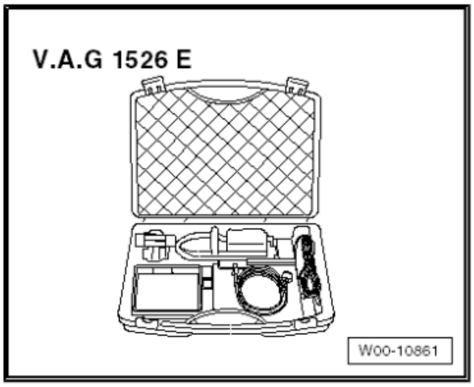
⇒ “11.7 Checking fuel gauge sender 4 G393 (tubular sender, right-side)”, page 211

⇒ “11.8 Removing and installing fuel gauge sender 4 G393 (tubular sender, right-side)”, page 213

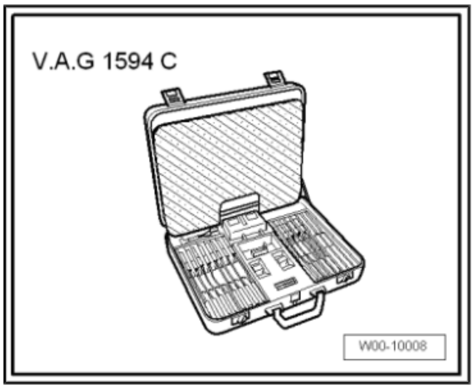
11.1 Checking fuel gauge sender - G- (lever-type sender, left-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-

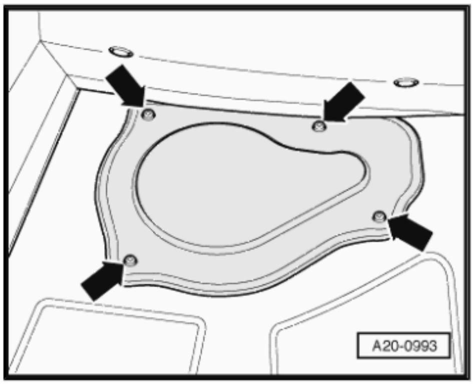


- Auxiliary measuring set - V.A.G 1594C-

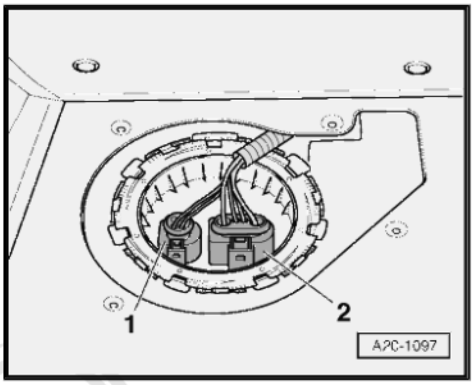


Procedure

- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



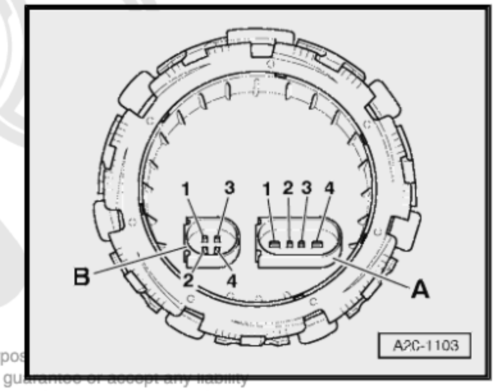
- Unplug electrical connector -1- on flange (left-side).



Note

Disregard -item 2-.

- Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 700 Ω	approx. 55 Ω

Note

- ◆ *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- ◆ *In order to test the maximum and minimum resistance values for "tank full" and "tank empty", remove the fuel gauge sender - G- ⇒ page 202 and move the float all the way to its top or bottom position.*
- ◆ *The following values are obtained with the fuel gauge sender - G- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 990 Ω	approx. 55 Ω

11.2 Removing and installing fuel gauge sender - G- (lever-type sender, left-side)

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

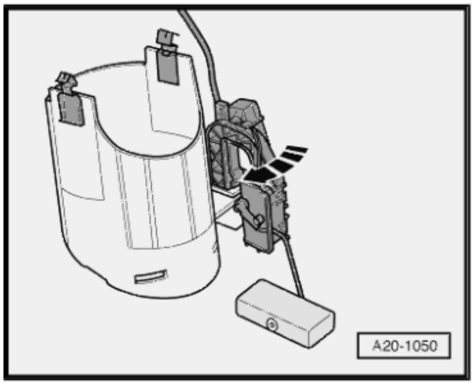
- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

- Remove fuel delivery unit (left-side):

- Vehicles with MPI engine ⇒ page 26 .
- Vehicles with FSI engine ⇒ page 70 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.

– Release fuel gauge sender - G- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender - G- into retainer so that it engages audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

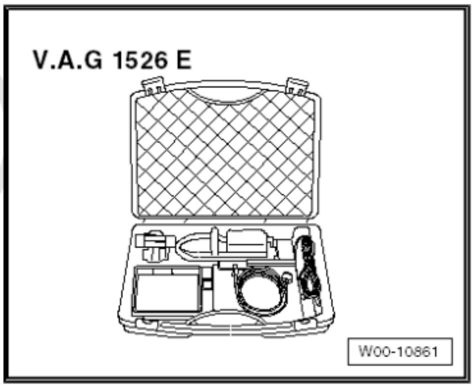
– Install fuel delivery unit (left-side):

- Vehicles with MPI engine ⇒ page 26 .
- Vehicles with FSI engine ⇒ page 70 .

11.3 Checking fuel gauge sender 2 - G169- (lever-type sender, right-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-

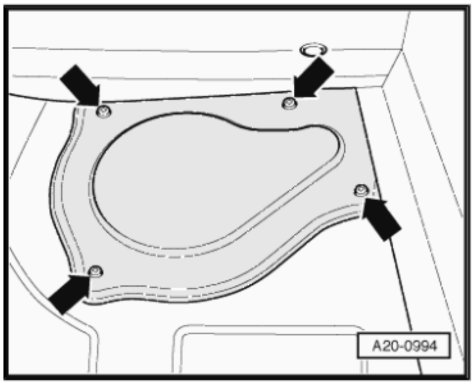


- Auxiliary measuring set - V.A.G 1594C-

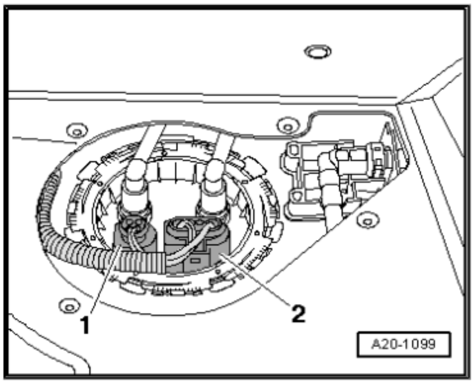
Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.



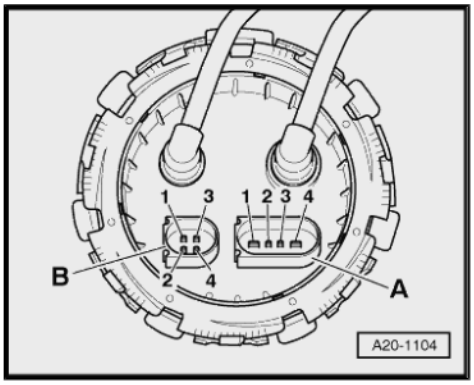
– Unplug electrical connector -1- on flange (right-side).



Note

Disregard -item 2-.

– Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 750 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 2 - G169- ⇒ page 204 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender 2 - G169- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 990 Ω	approx. 55 Ω

11.4 Removing and installing fuel gauge sender 2 - G169- (lever-type sender, right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 7 .

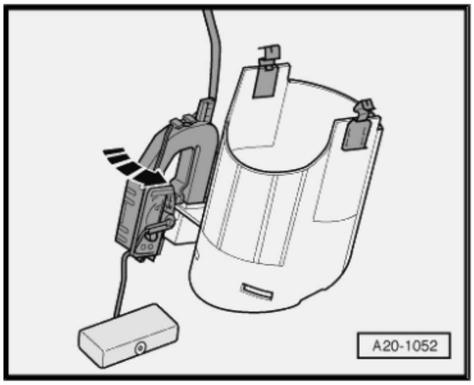
– Remove fuel delivery unit (right-side):

◆ Vehicles with MPI engine ⇒ page 42 .

◆ Vehicles with FSI engine ⇒ page 81 .

– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.

– Release fuel gauge sender 2 - G169- -arrow- and detach from retainer.



Installing

– Press fuel gauge sender 2 - G169- into retainer so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side):

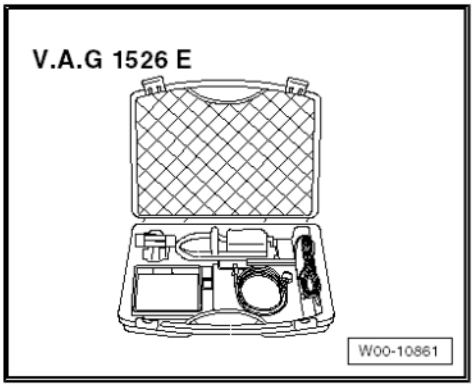
◆ Vehicles with MPI engine ⇒ page 42 .

◆ Vehicles with FSI engine ⇒ page 81 .

11.5 Checking fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

◆ Hand-held multimeter - V.A.G 1526 E-

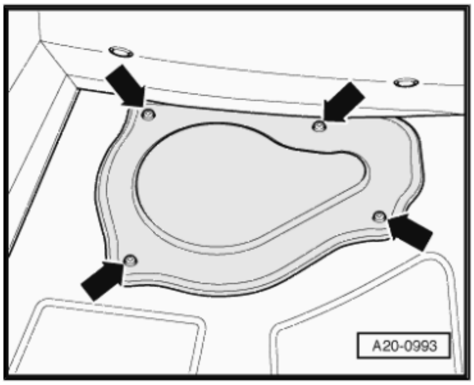


◆ Auxiliary measuring set - V.A.G 1594C-

Procedure

– Remove luggage compartment floor covering.

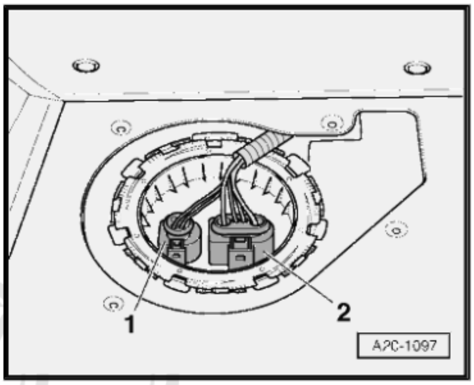
– Detach cover for flange (left-side) -arrows-.



– Unplug electrical connector -2- on flange (left-side).

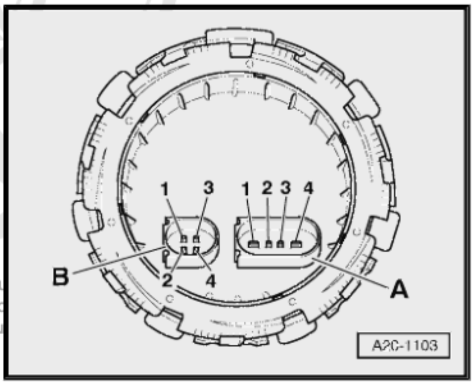
Note

Disregard -item 1-.



– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 3 - G237-	approx. 155 Ω	approx. 70 Ω



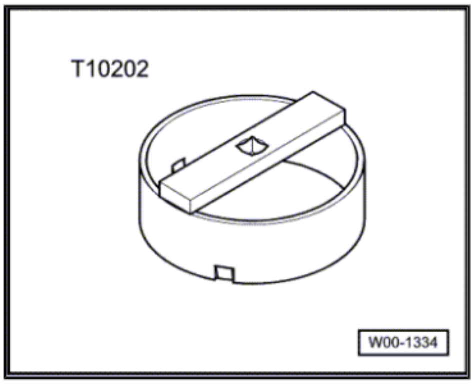
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 3 - G237- ⇒ page 206 and move the float all the way to its top or bottom position.*

11.6 Removing and installing fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

◆ Vehicles from approx. 11.2002: Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- The left fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.

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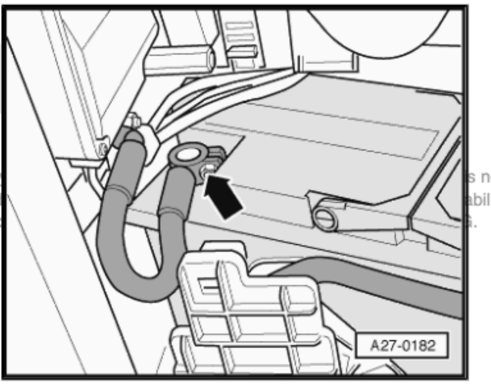
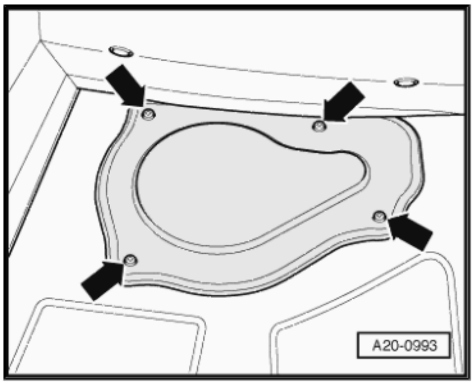


– Remove luggage compartment floor covering.

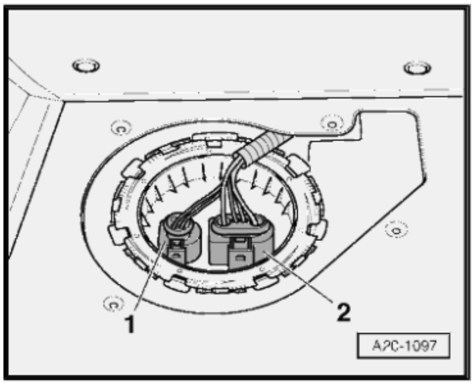
Note

For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

– Detach cover for flange (left-side) -arrows-.

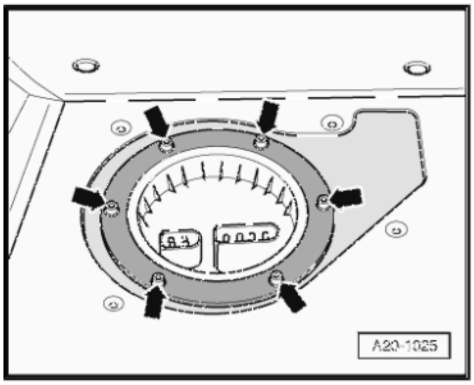


- Unplug electrical connectors -1- and -2- on flange (left-side).



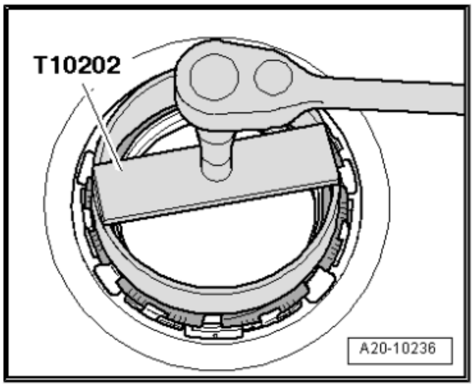
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (left-side).



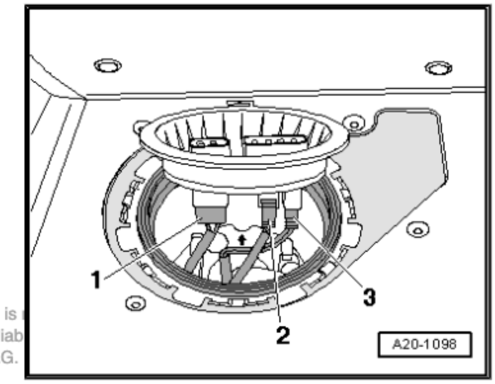
Vehicles from approx. 11.2002 onwards:

- Unscrew locking ring using wrench - T10202- .

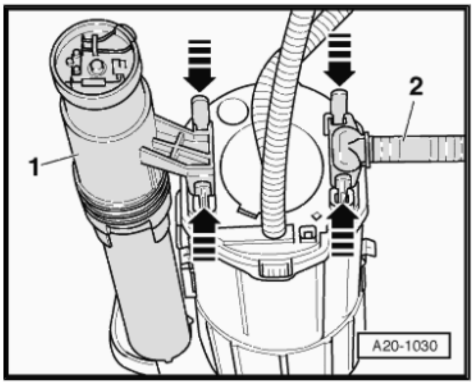


All vehicles (continued):

- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



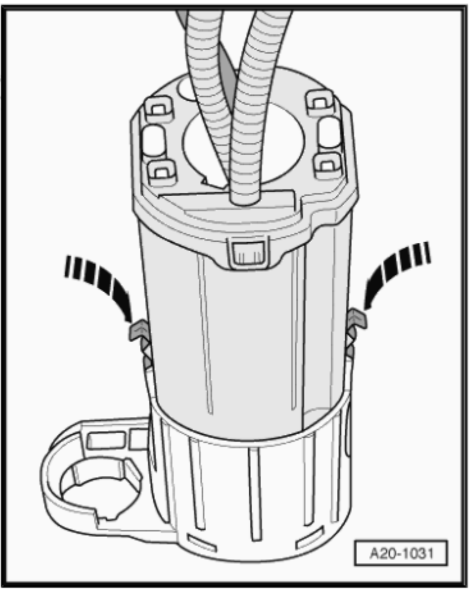
- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 3 - G237- .

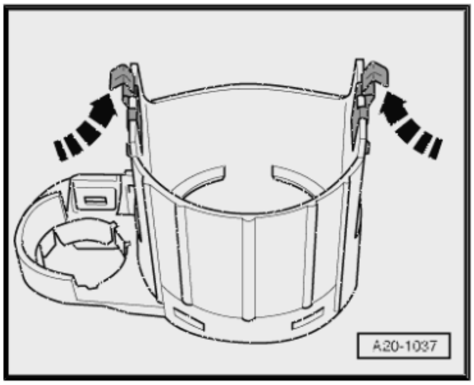
Note

Keep in mind that the fuel gauge sender 3 - G237- still contains fuel.

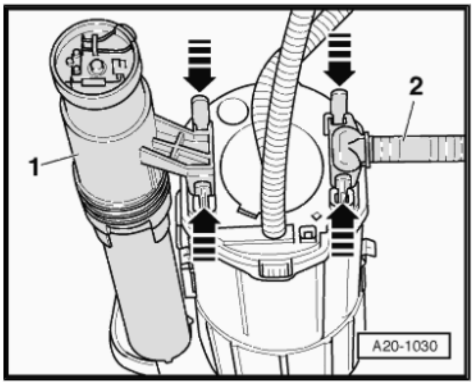


Installing

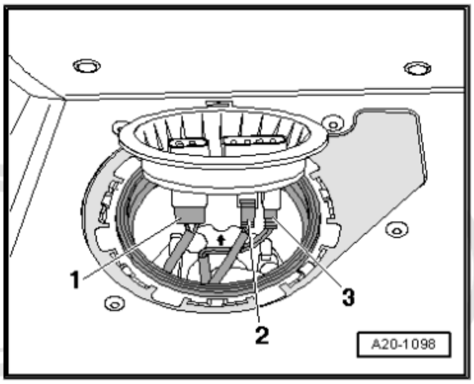
- Tightening torques ⇒ page 19
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.
- Pull fuel delivery unit up slightly and insert fuel gauge sender 3 - G237- .
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



- Connect electrical connectors -1 ... 3- on underside of flange (left-side).



Vehicles up to approx. 10.2002:

- Fit flange with new O-ring into fuel tank; note correct installation position:
- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)

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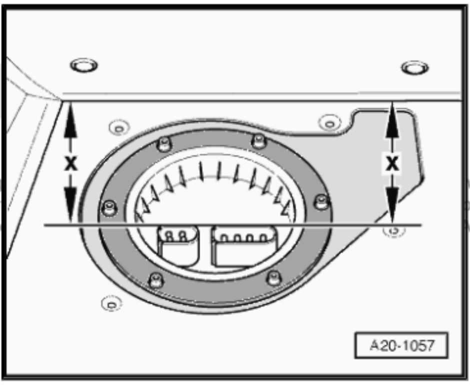
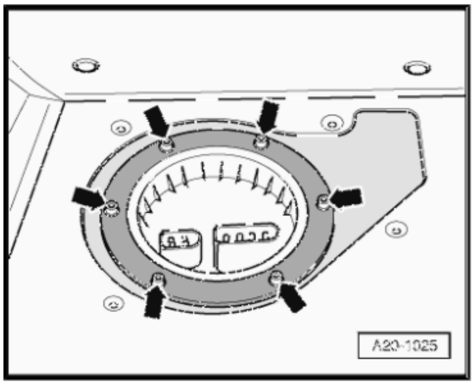
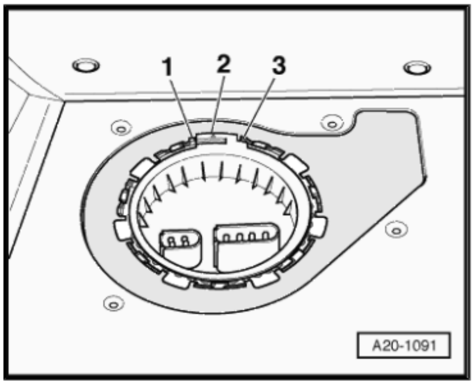


- Secure locking ring for flange (left-side) in diagonal sequence -arrows-.

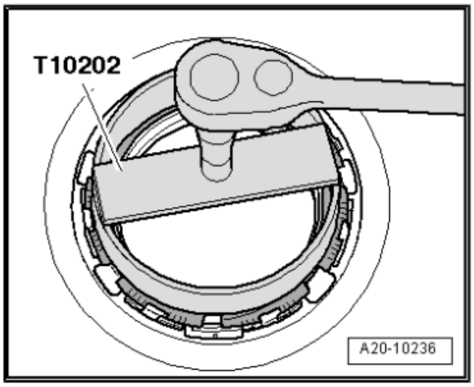


Vehicles from approx. 11.2002 onwards:

- Install new seal for flange (seal must be installed dry).
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.

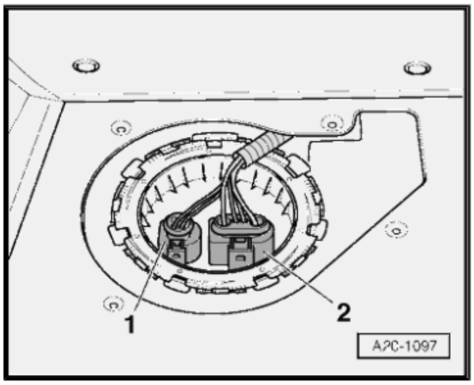


- Tighten locking ring.

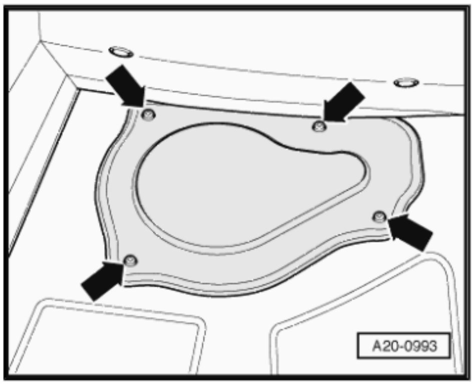


All vehicles (continued):

- Attach electrical connectors -1- and -2- on flange (left-side).



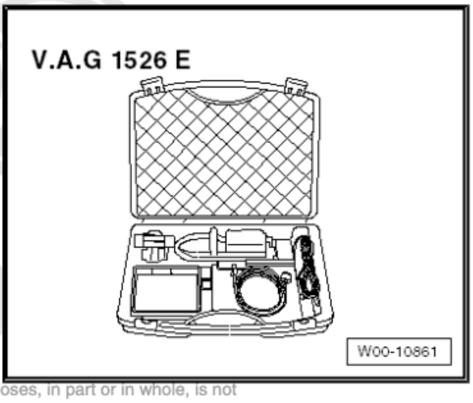
- Secure cover for flange (left-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



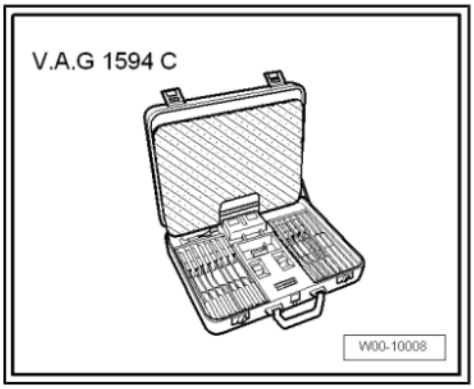
11.7 Checking fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- ♦ Hand-held multimeter - V.A.G 1526 E-



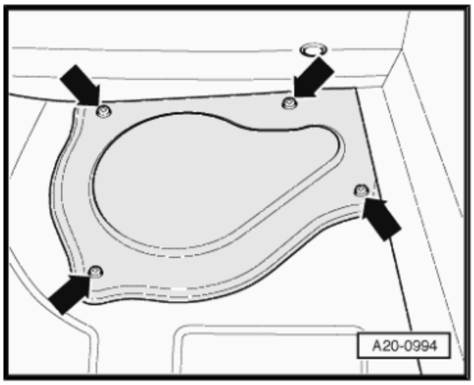
- Auxiliary measuring set - V.A.G 1594C-



Procedure

– Remove luggage compartment floor covering.

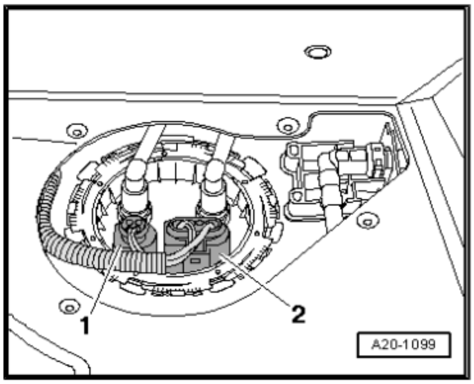
– Unscrew cover for flange (right-side) -arrows-.



– Unplug electrical connector -2- on flange (right-side).

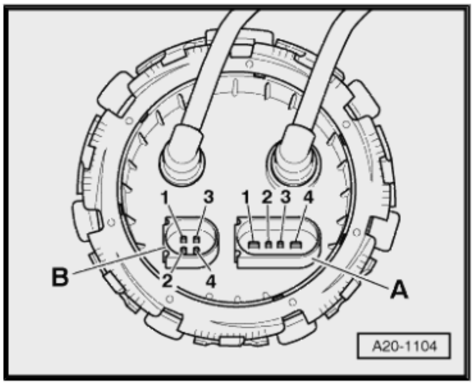
Note

Disregard -item 1-.



– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 4 - G393-	approx. 155 Ω	approx. 70 Ω



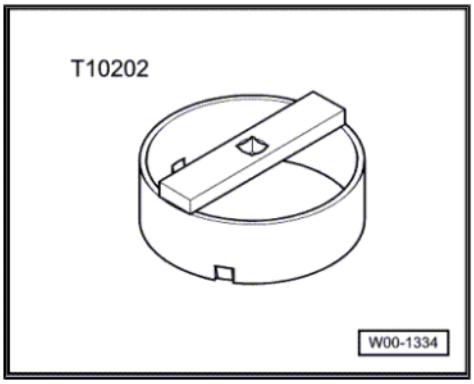
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 4 - G393- ⇒ page 213 and move the float all the way to its top or bottom position.*

11.8 Removing and installing fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Vehicles from approx. 11.2002: Wrench - T10202-



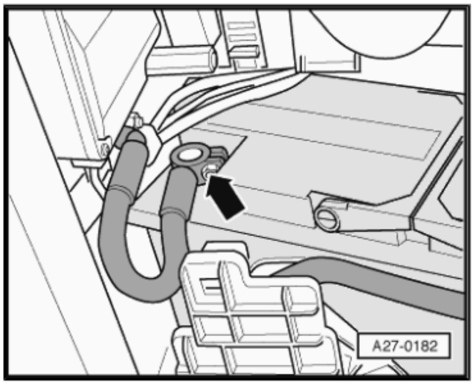
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

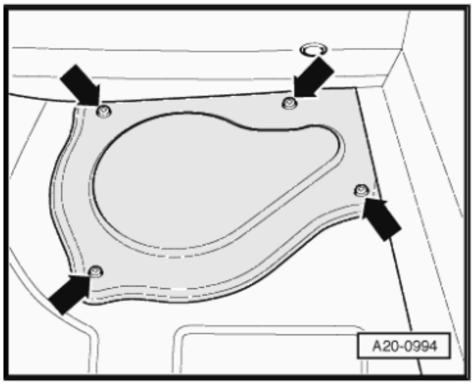
- The right fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 7 .

> Caution
>
> *Observe notes on procedure for disconnecting the battery.*



– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

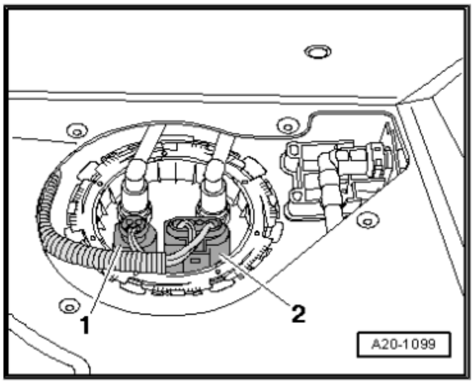
– Briefly open filler cap for fuel tank and close again.



– Remove luggage compartment floor covering.

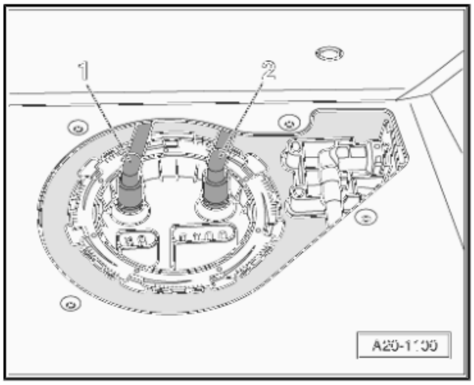
– Unscrew cover for flange (right-side) -arrows-.

- Unplug electrical connectors -1- and -2- on flange (right-side).



- Mark fuel return line -1- and fuel supply line -2-.

> WARNING
>
> *The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.*



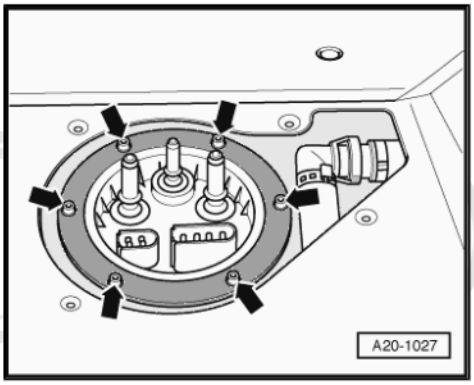
- Detach both lines from flange (press release tabs).

Vehicles with auxiliary heater:

- In addition, disconnect fuel supply line for auxiliary heater.

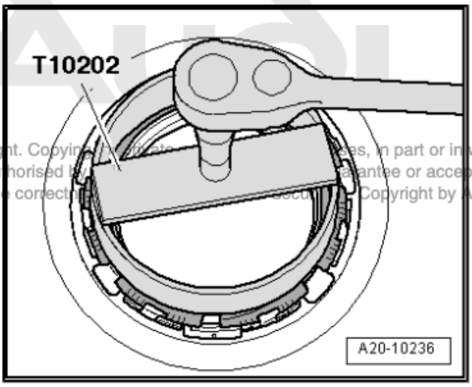
Vehicles up to approx. 10.2002:

- Remove bolts -arrows- and take off locking ring for flange (right-side).



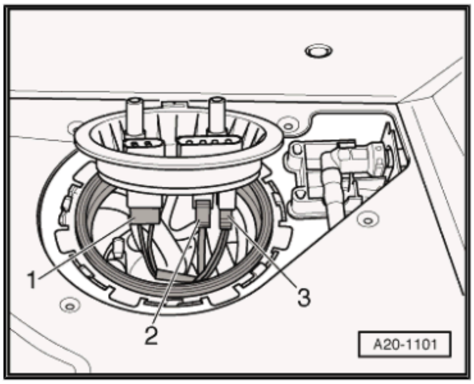
Vehicles from approx. 11.2002 onwards:

- Unscrew locking ring using wrench - T10202- .



All vehicles (continued):

- Detach flange and remove seal/O-ring.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).

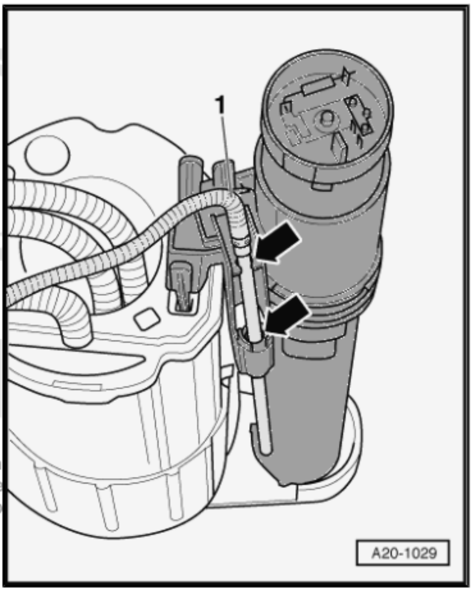


Note

- *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with auxiliary heater:

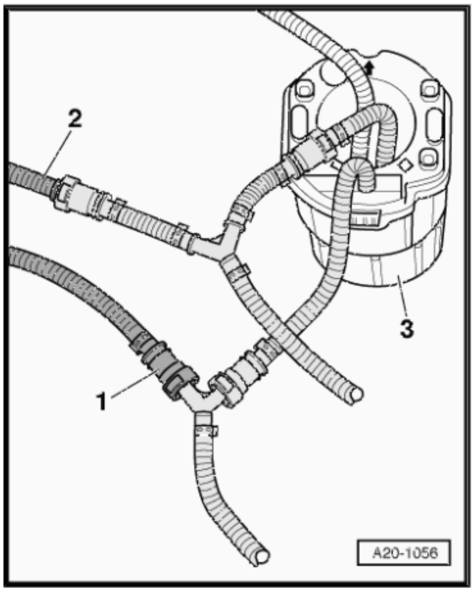
- Pull out suction pipe -1- for auxiliary heater from retainers -arrows- on tubular sender.



Vehicles with MPI engine:

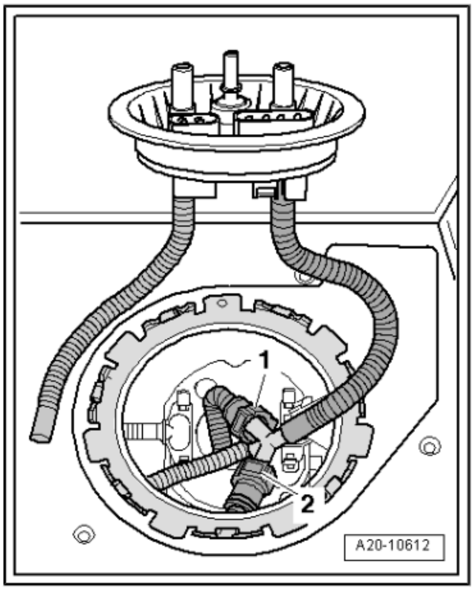
- Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-



Vehicles with FSI engine:

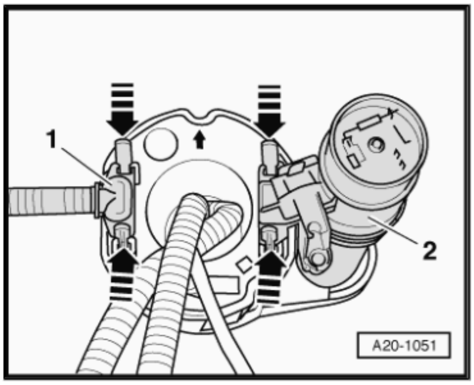
– Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



All vehicles (continued):

– Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.

– Move fuel gauge sender 4 - G393- to right side.

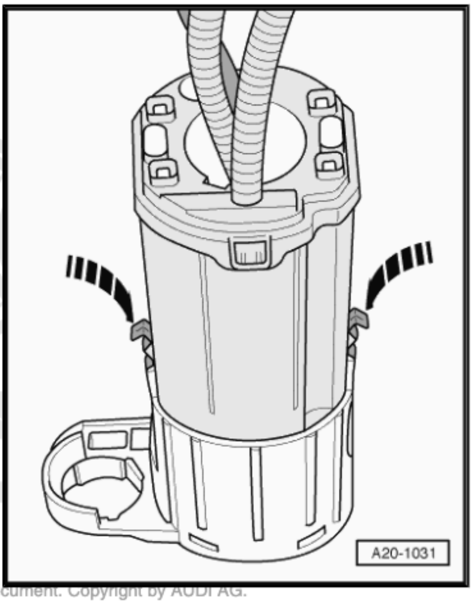


– Press down both retaining clips on retainer for fuel delivery unit -arrows-.

– Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 4 - G393- .

Note

Keep in mind that the fuel gauge sender 4 - G393- still contains fuel.



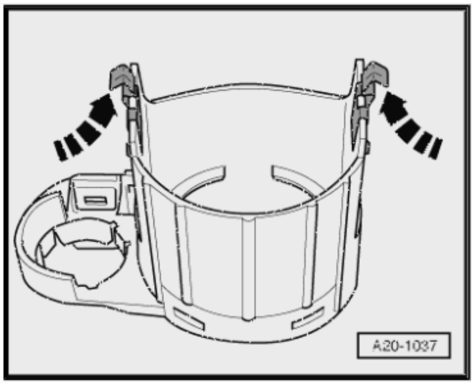
Installing

- Tightening torques ⇒ page 36

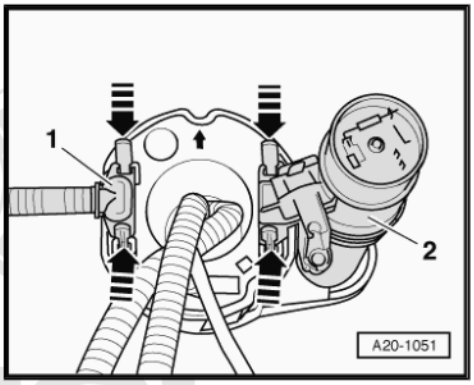
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Pull fuel delivery unit up slightly and insert fuel gauge sender 4 - G393- .

– Then press fuel delivery unit carefully into retainer so that it engages audibly.



– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly.



Vehicles with MPI engine:

– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

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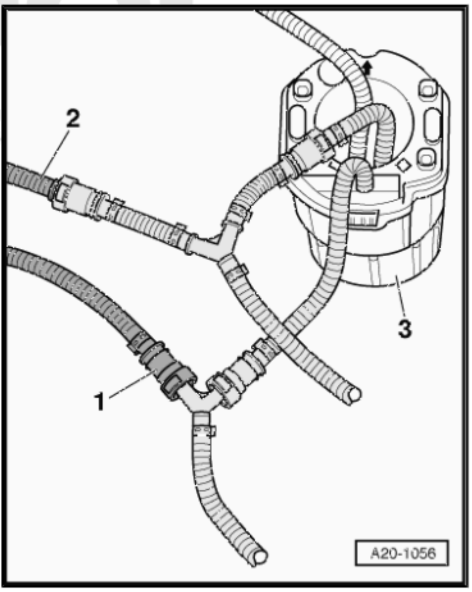
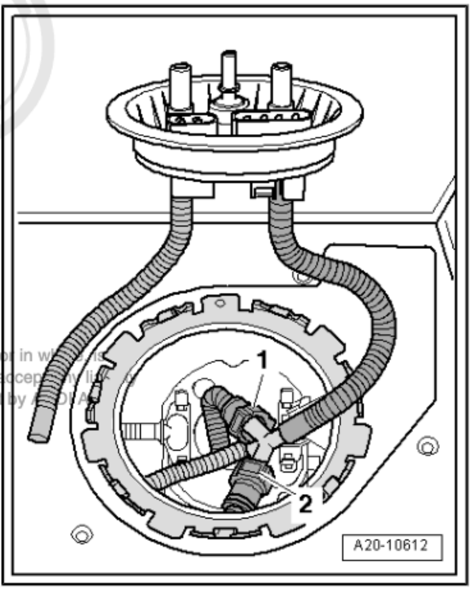
3 - Fuel delivery unit (right-side) with fuel pump - G23-



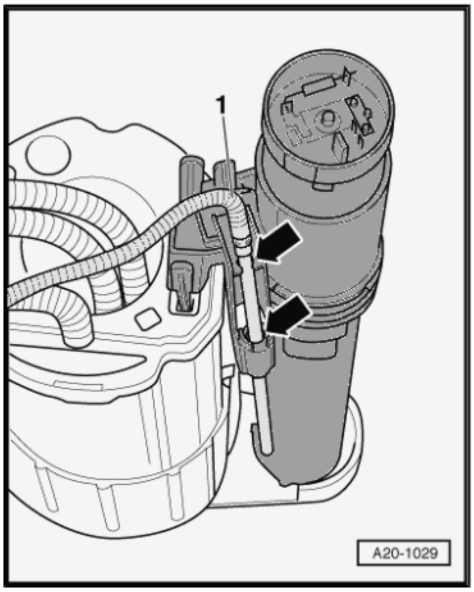
Vehicles with FSI engine:

– Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.



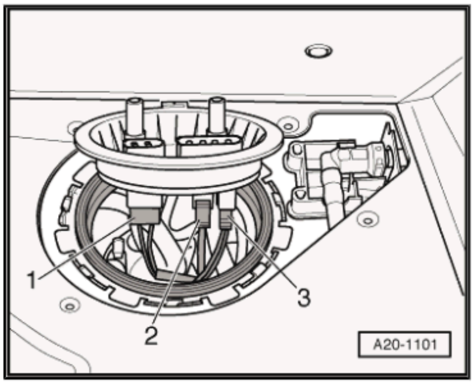
Vehicles with auxiliary heater:

– Fit suction pipe -1- for auxiliary heater into retainers -arrows- on tubular sender.



All vehicles (continued):

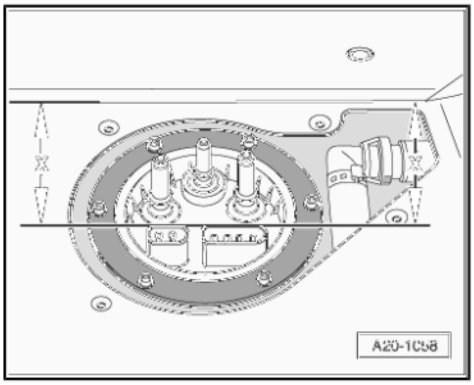
– Connect electrical connectors -1 ... 3- on underside of flange (right-side).



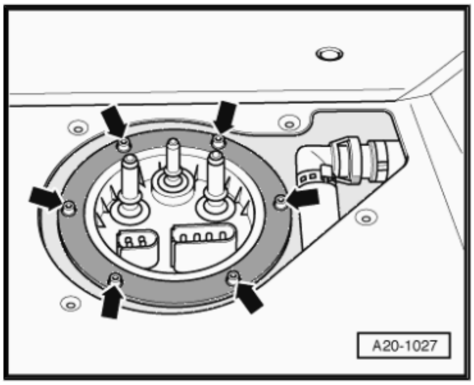
Vehicles up to approx. 10.2002:

– Fit flange with new O-ring into fuel tank; note correct installation position:

- The electrical connectors are positioned transversely in relation to direction of travel.
- Dimension -x- (left-side) = dimension -x- (right-side)



– Secure locking ring for flange (right-side) in diagonal sequence -arrows-.

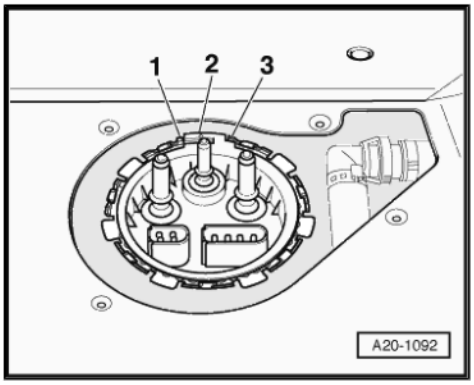


Vehicles from approx. 11.2002 onwards:

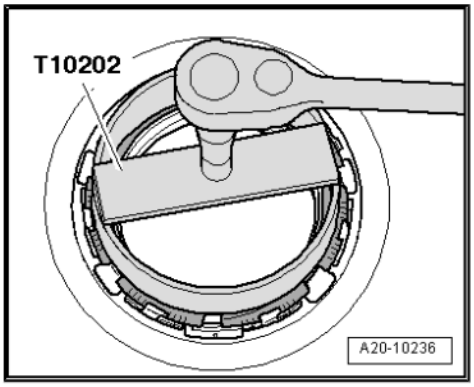
– Install new seal for flange (seal must be installed dry).

– Fit flange into fuel tank; note correct installation position:

- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



– Tighten locking ring.

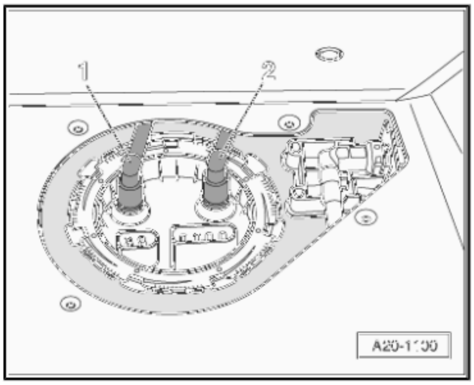


All vehicles (continued):

– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

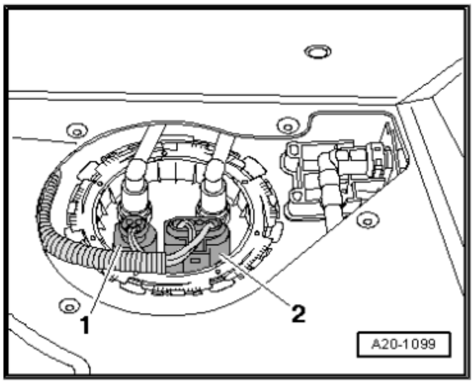
Vehicles with auxiliary heater:

– Also fit fuel supply line going to auxiliary heater so that it engages audibly.



All vehicles (continued):

– Attach electrical connectors -1- and -2- on flange (right-side).

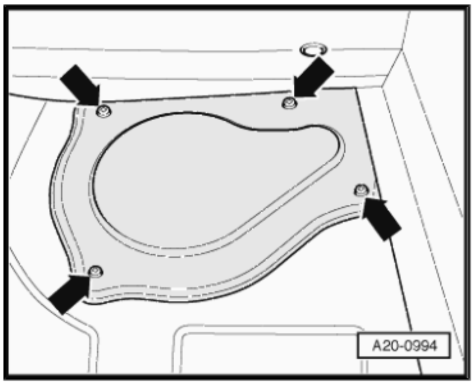


– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .

Vehicles with auxiliary heater:

– Let auxiliary heater run with full load for 10 minutes to bleed fuel supply line going to metering pump.



12 Fuel gauge senders - USA vehicles

⇒ “12.1 Checking fuel gauge sender G (lever-type sender, left-side)”, page 221

⇒ “12.2 Removing and installing fuel gauge sender G (lever-type sender, left-side)”, page 222

⇒ “12.3 Checking fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 223

⇒ “12.4 Removing and installing fuel gauge sender 2 G169 (lever-type sender, right-side)”, page 224

⇒ “12.5 Checking fuel gauge sender 3 G237 (tubular sender, left-side)”, page 225

⇒ “12.6 Removing and installing fuel gauge sender 3 G237 (tubular sender, left-side)”, page 226

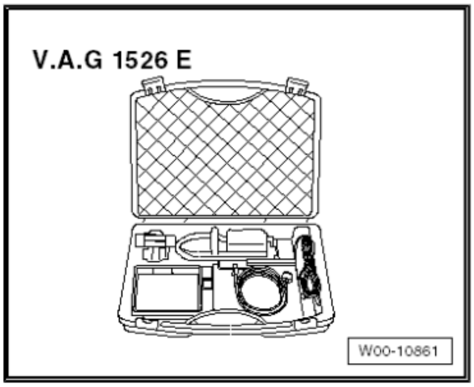
⇒ “12.7 Checking fuel gauge sender 4 G393 (tubular sender, right-side)”, page 230

⇒ “12.8 Removing and installing fuel gauge sender 4 G393 (tubular sender, right-side)”, page 232

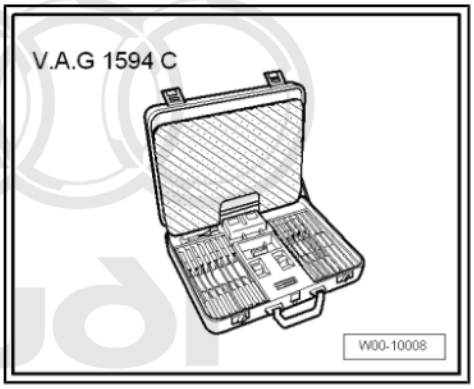
12.1 Checking fuel gauge sender - G- (lever-type sender, left-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-

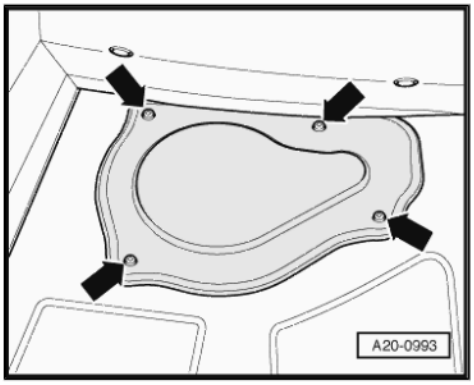


- Auxiliary measuring set - V.A.G 1594C-

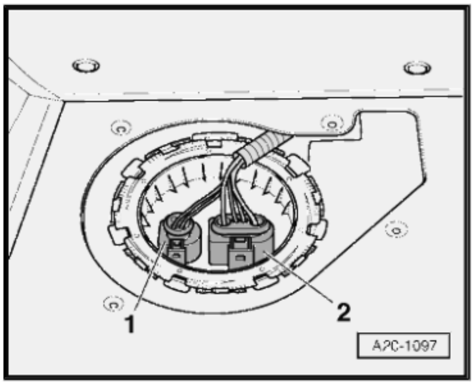


Procedure

- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



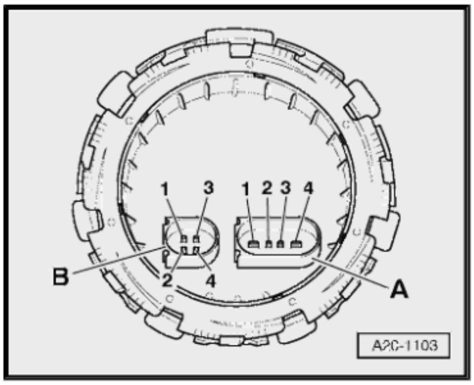
- Unplug electrical connector -1- on flange (left-side).



Note

Disregard -item 2-.

- Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 700 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum resistance values for "tank full" and "tank empty", remove the fuel gauge sender - G- ⇒ page 222 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender -G- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender - G-	approx. 990 Ω	approx. 55 Ω

12.2 Removing and installing fuel gauge sender - G- (lever-type sender, left-side)

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

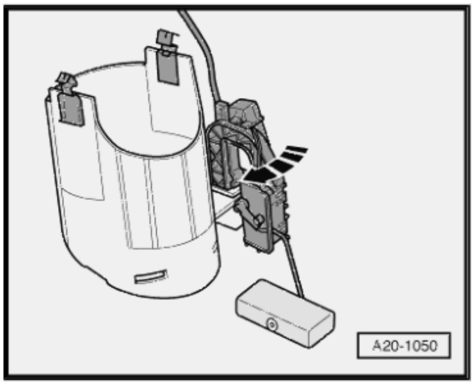
- *The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 112 .*

– Remove fuel delivery unit (left-side):

◆ Vehicles with MPI engine ⇒ page 129 .

◆ Vehicles with FSI engine ⇒ page 167 .

– Remove fuel gauge sender 3 - G237- (tubular sender, left-side) from fuel tank.



– Release fuel gauge sender - G- -arrow- and detach from retainer.

Installing

– Press fuel gauge sender - G- into retainer so that it engages audibly.

– Insert fuel gauge sender 3 - G237- into fuel tank.

– Install fuel delivery unit (left-side):

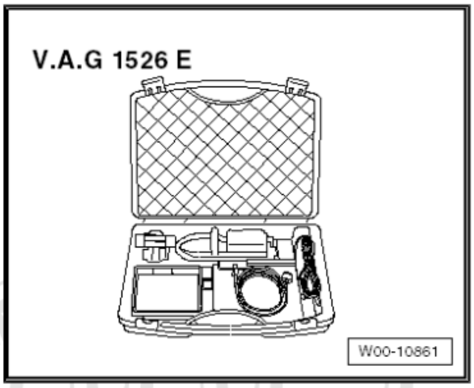
◆ Vehicles with MPI engine ⇒ page 129 .

◆ Vehicles with FSI engine ⇒ page 167 .

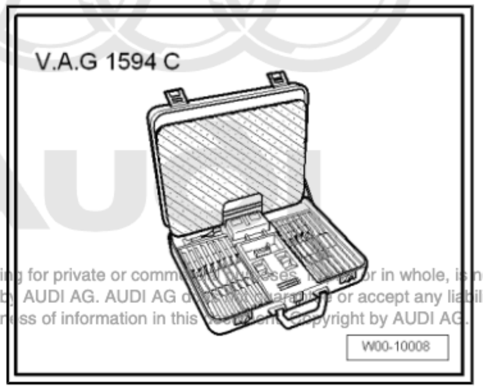
12.3 Checking fuel gauge sender 2 - G169- (lever-type sender, right-side)

Special tools and workshop equipment required

◆ Hand-held multimeter - V.A.G 1526 E-

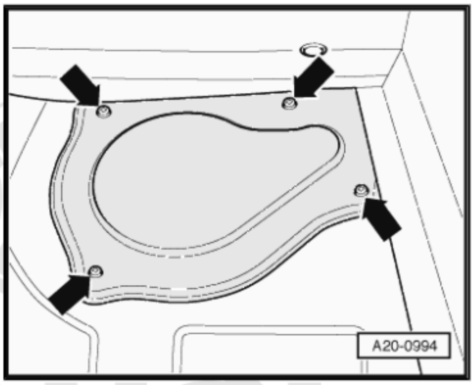


◆ Auxiliary measuring set - V.A.G 1594C-

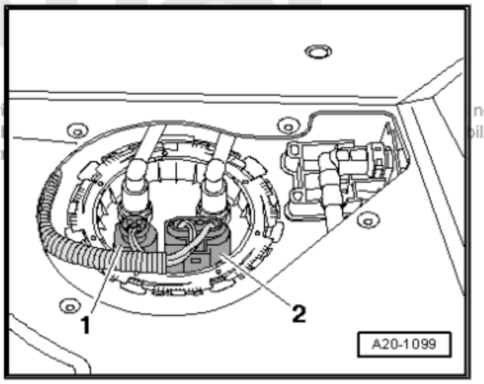


Procedure

- Remove luggage compartment floor covering.
- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connector -1- on flange (right-side).



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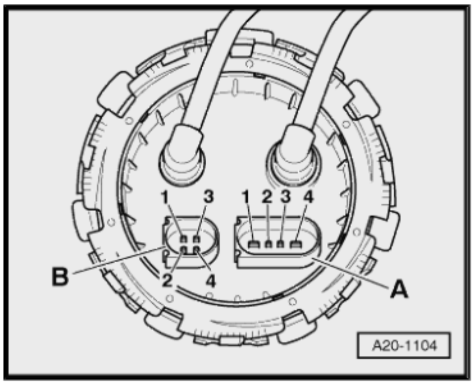
Note

Disregard -item 2-.

- Connect hand-held multimeter between contacts -2- and -4- of connector -B- to measure resistance.



Sender installed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 750 Ω	approx. 55 Ω

Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 2 - G169- ⇒ page 224 and move the float all the way to its top or bottom position.*
- *The following values are obtained with the fuel gauge sender 2 - G169- removed, due to the greater travel of the float arm:*

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 2 - G169-	approx. 990 Ω	approx. 55 Ω

12.4 Removing and installing fuel gauge sender 2 - G169- (lever-type sender, right-side)

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

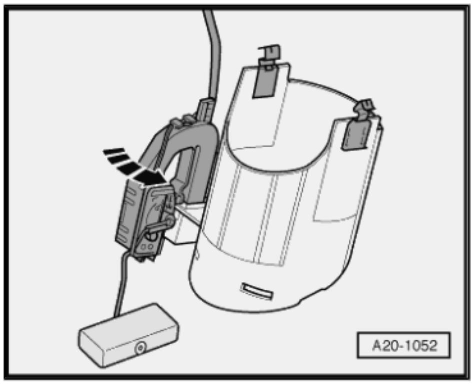
- *The fuel tank must be drained completely before removing the lever-type sender. Procedure for draining the fuel tank ⇒ page 112 .*

– Remove fuel delivery unit (right-side):

◆ Vehicles with MPI engine ⇒ page 141 .

◆ Vehicles with FSI engine ⇒ page 177 .

– Remove fuel gauge sender 4 - G393- (tubular sender, right-side) from fuel tank.



– Release fuel gauge sender 2 - G169- -arrow- and detach from retainer.

Installing

– Press fuel gauge sender 2 - G169- into retainer so that it engages audibly.

– Insert fuel gauge sender 4 - G393- into fuel tank.

– Install fuel delivery unit (right-side):

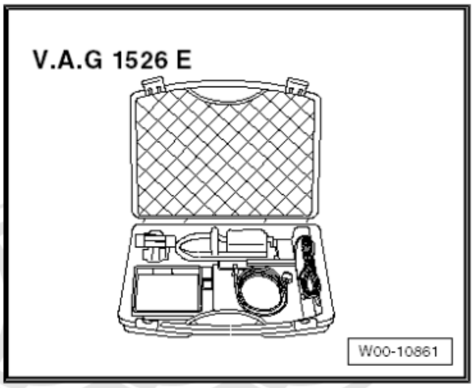
◆ Vehicles with MPI engine ⇒ page 141 .

◆ Vehicles with FSI engine ⇒ page 177 .

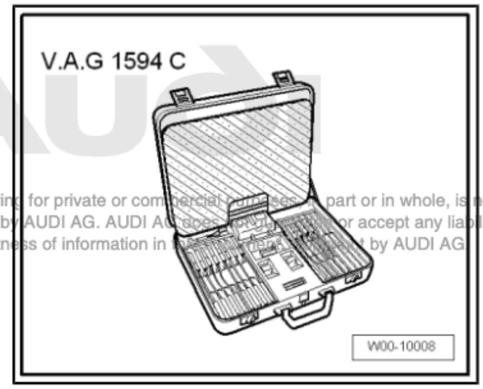
12.5 Checking fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

◆ Hand-held multimeter - V.A.G 1526 E-

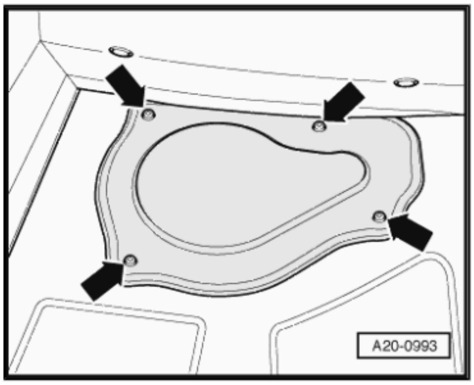


◆ Auxiliary measuring set - V.A.G 1594C-

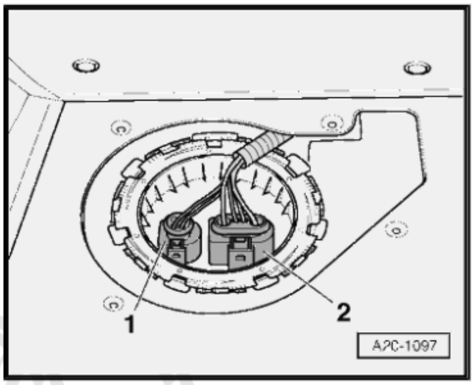


Procedure

- Remove luggage compartment floor covering.
- Detach cover for flange (left-side) -arrows-.



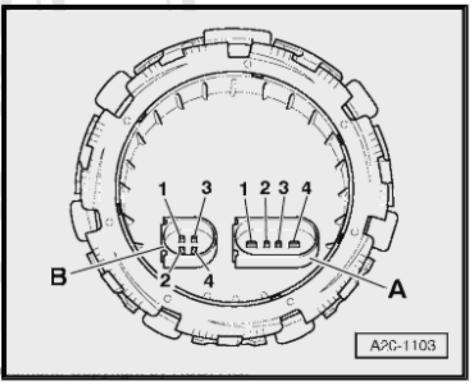
- Unplug electrical connector -2- on flange (left-side).



Note

Disregard -item 1-.

- Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.



Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 3 - G237-	approx. 155 Ω	approx. 70 Ω

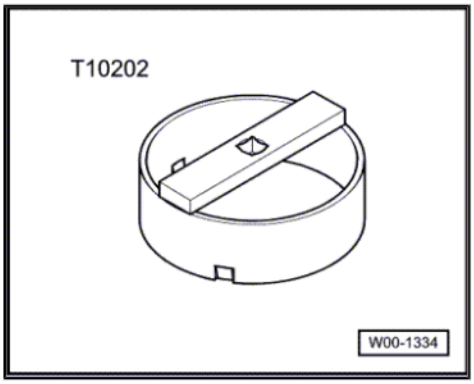
Note

- ◆ *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- ◆ *In order to test the maximum and minimum values for “tank full” and “tank empty”, remove the fuel gauge sender 3 - G237- ⇒ page 226 and move the float all the way to its top or bottom position.*

12.6 Removing and installing fuel gauge sender 3 - G237- (tubular sender, left-side)

Special tools and workshop equipment required

- Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

Caution

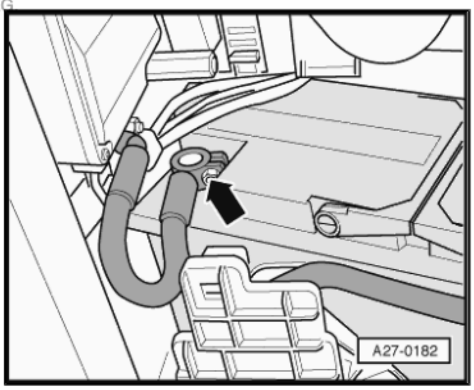
- *The left fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 112 .*

Caution

Observe notes on procedure for disconnecting the battery.

– With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .

– Briefly open filler cap for fuel tank and close again.

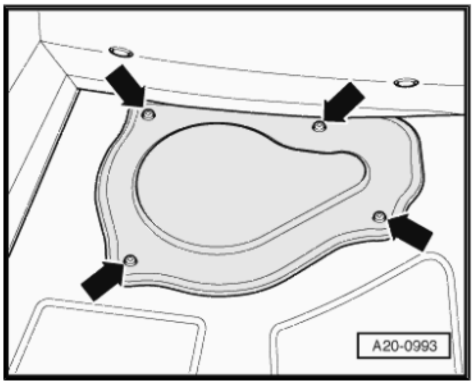


– Remove luggage compartment floor covering.

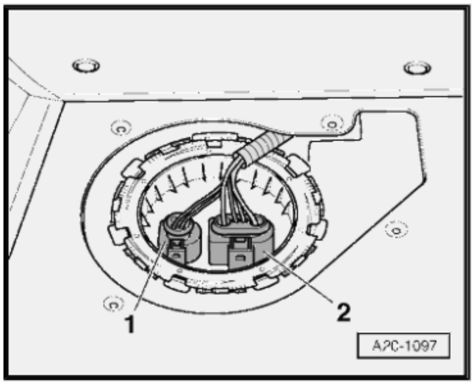
Note

For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

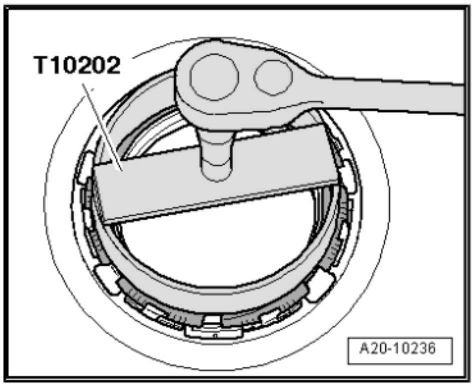
– Detach cover for flange (left-side) -arrows-.



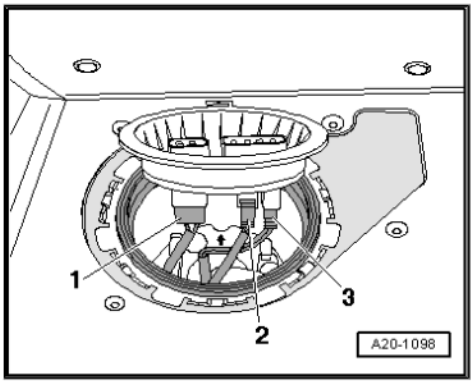
- Unplug electrical connectors -1- and -2- on flange (left-side).



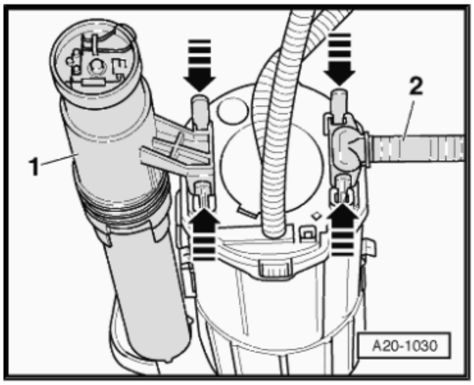
- Unscrew locking ring using wrench - T10202- .



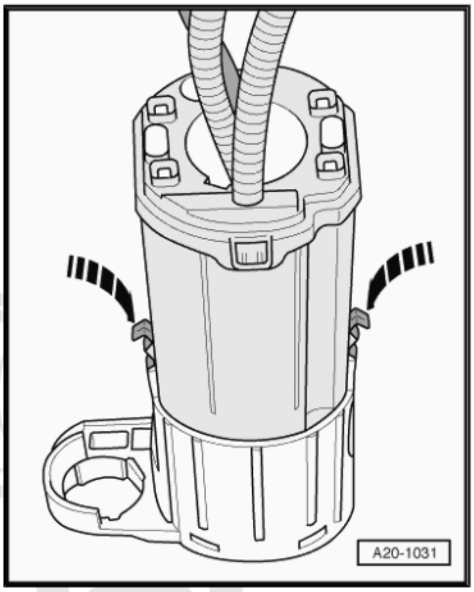
- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (left-side).



- Working through left fuel tank opening, press release tabs -arrows- and detach fuel supply line -2- and fuel gauge sender 3 - G237- -item 1-.
- Move fuel gauge sender 3 - G237- to left side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 3 - G237- .



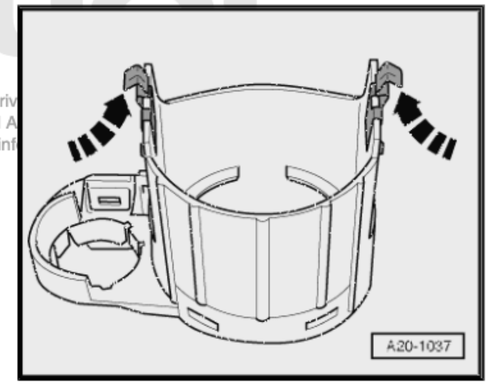
Note

Keep in mind that the fuel gauge sender 3 - G237- still contains fuel.

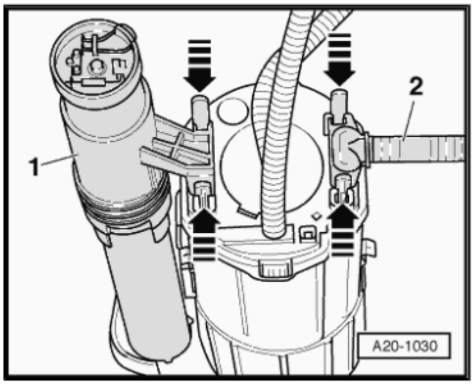
Installing

- Tightening torques ⇒ page 123
- Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

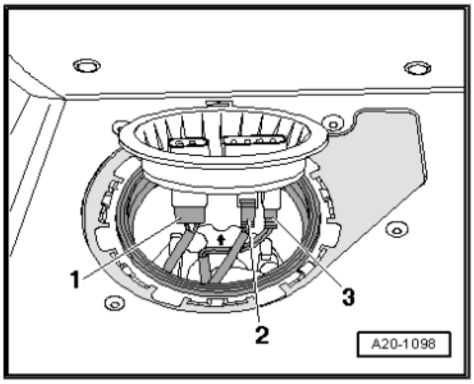
- Pull fuel delivery unit up slightly and insert fuel gauge sender 3 - G237- .
- Then press fuel delivery unit carefully into retainer so that it engages audibly.



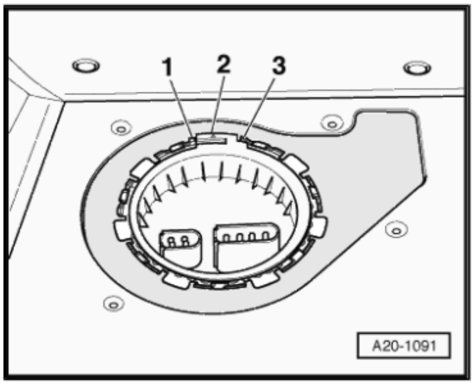
- Fit fuel supply line -2- and fuel gauge sender 3 - G237- -item 1- so that they engage audibly.



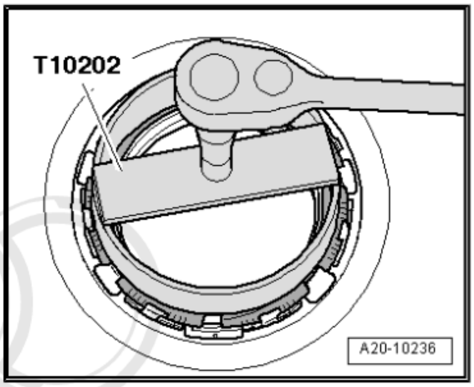
- Connect electrical connectors -1 ... 3- on underside of flange (left-side).
- Install new seal for flange (seal must be installed dry).



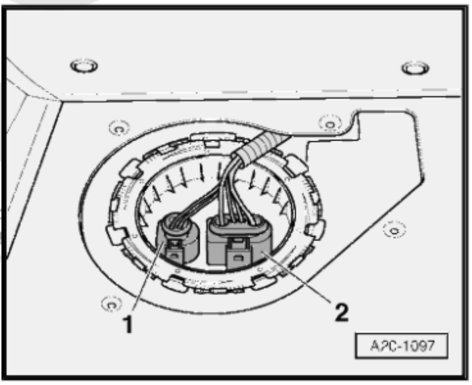
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



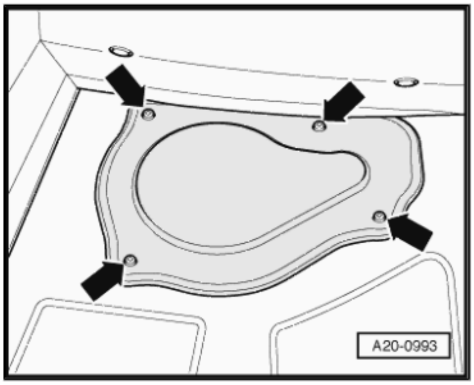
- Tighten locking ring.



- Attach electrical connectors -1- and -2- on flange (left-side).



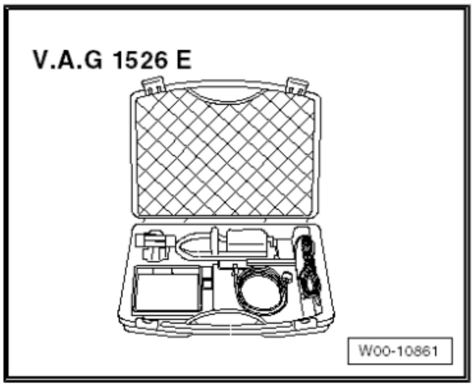
- Secure cover for flange (left-side) -arrows-.
- Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



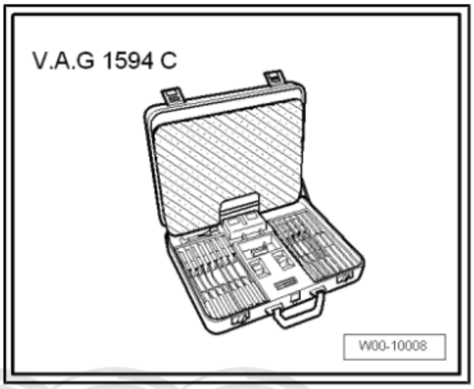
12.7 Checking fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Hand-held multimeter - V.A.G 1526 E-



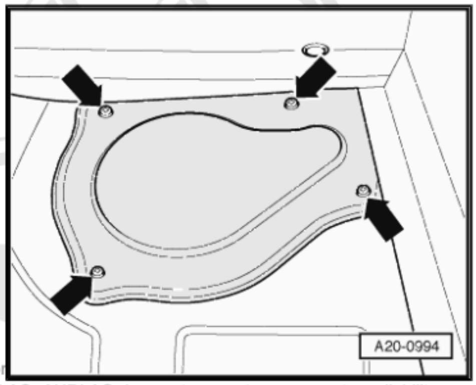
- Auxiliary measuring set - V.A.G 1594C-



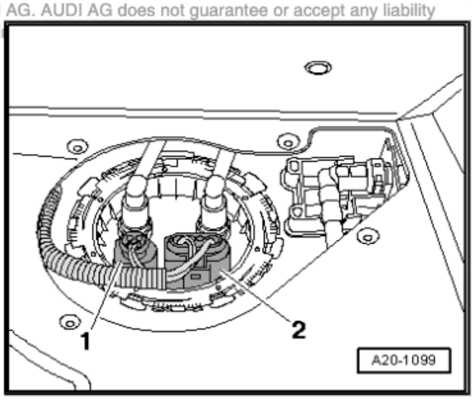
Procedure

– Remove luggage compartment floor covering.

– Unscrew cover for flange (right-side) -arrows-.

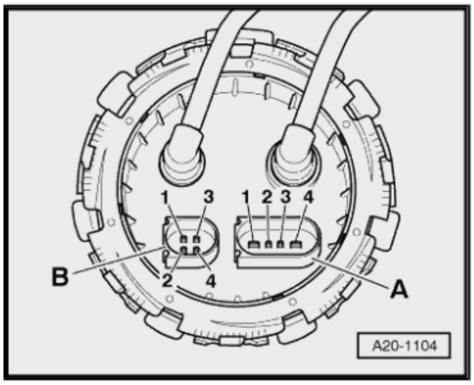


– Unplug electrical connector -2- on flange (right-side).



Note

Disregard -item 1-.



– Connect hand-held multimeter between contacts -2- and -3- of connector -A- to measure resistance.

Sender removed	Sender at lower stop	Sender at upper stop
Fuel gauge sender 4 - G393-	approx. 155 Ω	approx. 70 Ω

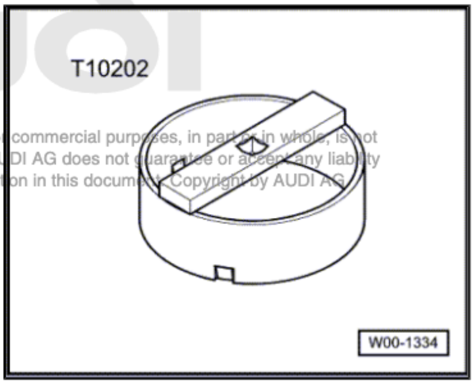
Note

- *If the resistance is 0 Ω, there is a short circuit. If the resistance is ∞ Ω, there is an open circuit in the wiring.*
- *In order to test the maximum and minimum values for "tank full" and "tank empty", remove the fuel gauge sender 4 - G393- ⇒ page 232 and move the float all the way to its top or bottom position.*

12.8 Removing and installing fuel gauge sender 4 - G393- (tubular sender, right-side)

Special tools and workshop equipment required

- Wrench - T10202-



Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

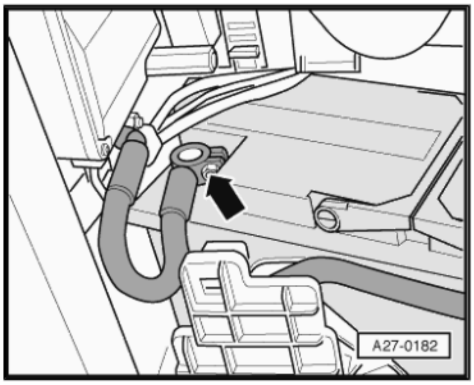
Caution

- *The right fuel tank chamber must not be more than $^1/_3$ full when removing the tubular sender. Procedure for draining the fuel tank ⇒ page 112 .*

Caution

Observe notes on procedure for disconnecting the battery.

- With ignition switched off, disconnect battery earth cable -arrow- ⇒ Electrical system; Rep. gr. 27 .
- Briefly open filler cap for fuel tank and close again.

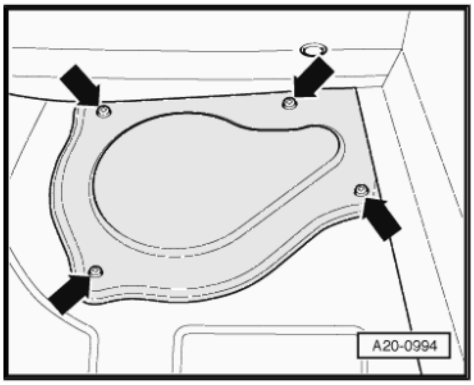


- Remove luggage compartment floor covering.

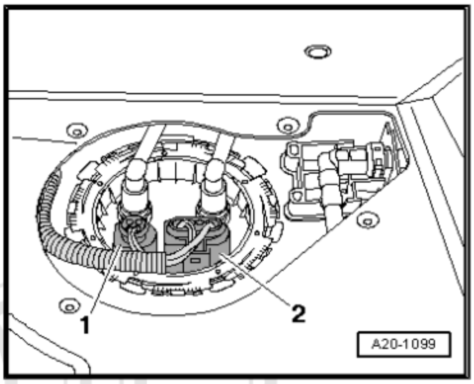
Note

For removing and installing tubular sender, take tool kit and spare wheel out of luggage compartment. You can then sit or kneel in the spare wheel well.

- Unscrew cover for flange (right-side) -arrows-.



- Unplug electrical connectors -1- and -2- on flange (right-side).

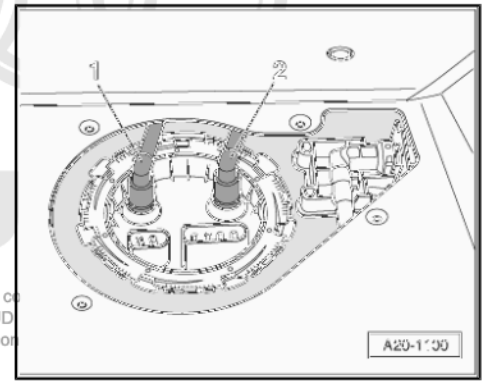


- Mark fuel return line -1- and fuel supply line -2-.

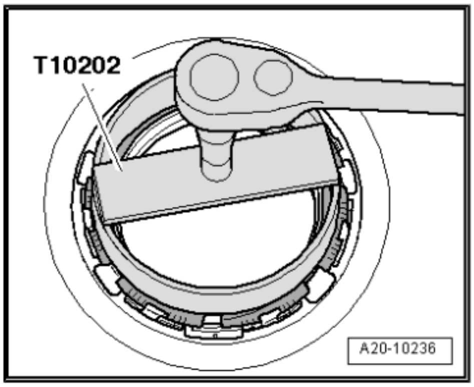
WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.

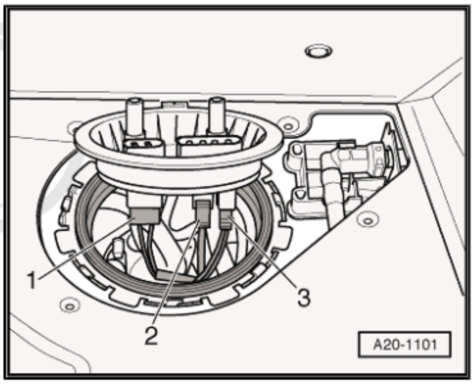
- Detach both lines from flange (press release tabs).



- Unscrew locking ring using wrench - T10202- .



- Detach flange and remove seal.
- Unplug electrical connectors -1 ... 3- on underside of flange (right-side).



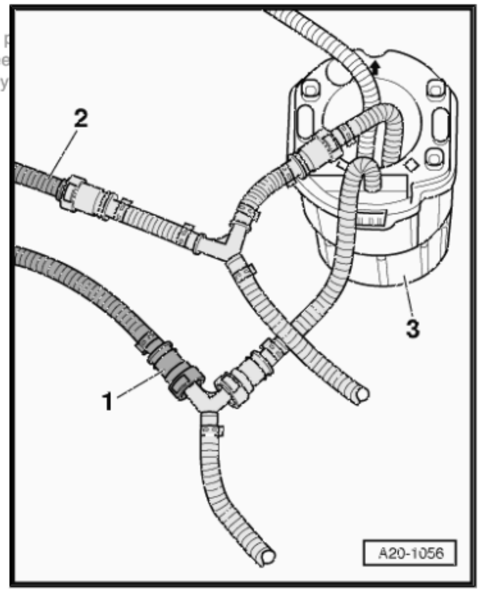
Note

- ♦ *Pull out fuel lines from fuel tank opening prior to disconnecting the pipe connectors mentioned below.*
- ♦ *For illustration purposes some of the components are shown removed in the following illustrations.*

Vehicles with MPI engine:

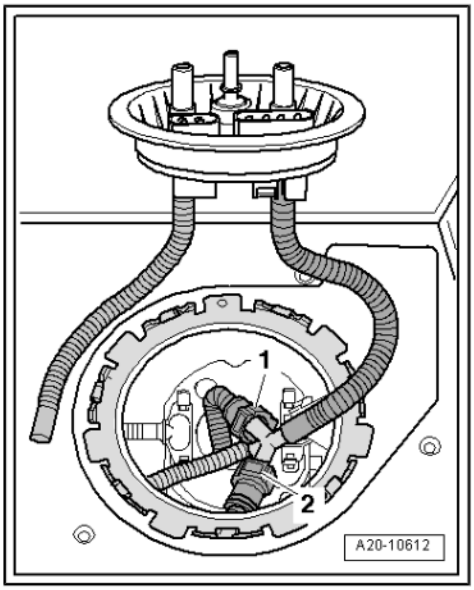
- Working through right fuel tank opening, press release tabs and disconnect fuel lines -1- and -2- going to fuel delivery unit (left-side).

3 - Fuel delivery unit (right-side) with fuel pump - G23-



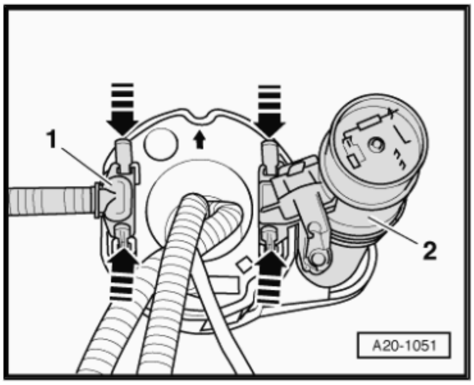
Vehicles with FSI engine:

- Working through right fuel tank opening, press release tabs and disconnect fuel supply lines -1- and -2- going to fuel delivery units.



All vehicles (continued):

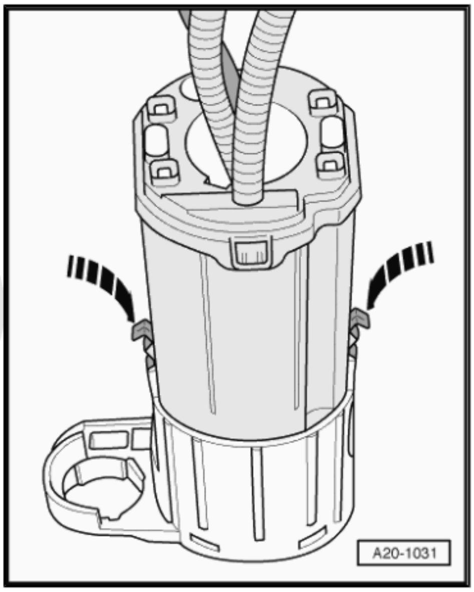
- Working through right fuel tank opening, press release tabs -arrows- and detach fuel supply line -1- and fuel gauge sender 4 - G393- -item 2-.
- Move fuel gauge sender 4 - G393- to right side.



- Press down both retaining clips on retainer for fuel delivery unit -arrows-.
- Pull fuel delivery unit slightly upwards and at the same time take out fuel gauge sender 4 - G393- .

Note

Keep in mind that the fuel gauge sender 4 - G393- still contains fuel.



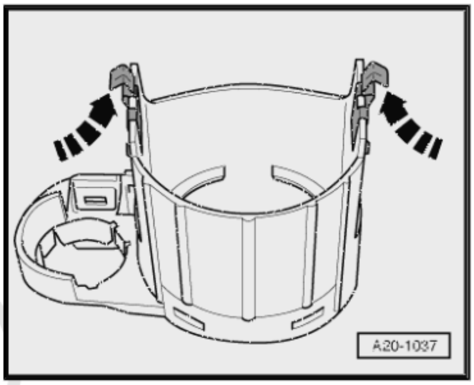
Installing

- Tightening torques ⇒ page 136

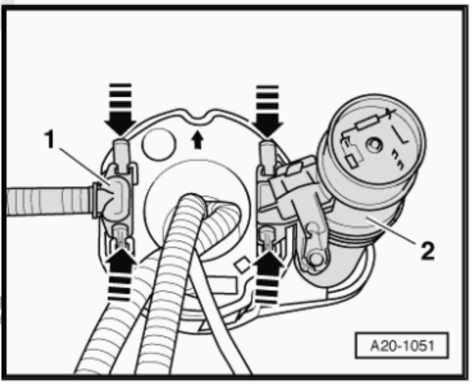
– Pull both retaining clips on retainer upwards -arrows- so that they engage audibly before installing the fuel delivery unit.

– Pull fuel delivery unit up slightly and insert fuel gauge sender 4 - G393- .

– Then press fuel delivery unit carefully into retainer so that it engages audibly.



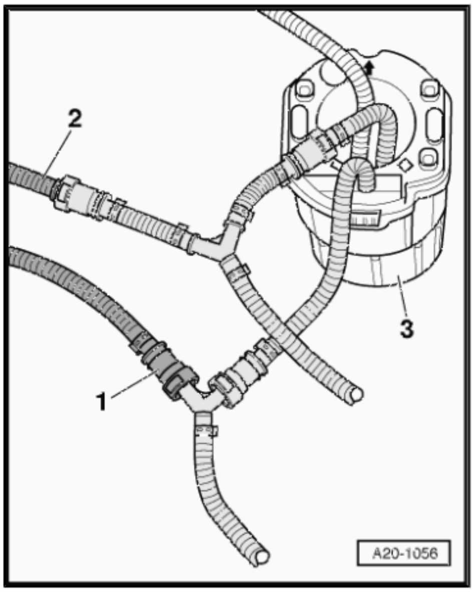
– Fit fuel supply line -1- and fuel gauge sender 4 - G393- -item 2- so that they engage audibly.



Vehicles with MPI engine:

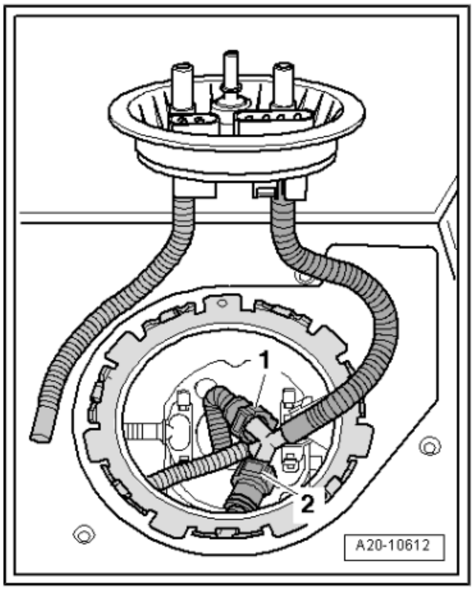
– Working through right fuel tank opening, connect fuel lines -1- and -2- going to left fuel delivery unit so that they engage audibly.

3 - Fuel delivery unit (right-side) with fuel pump - G23-



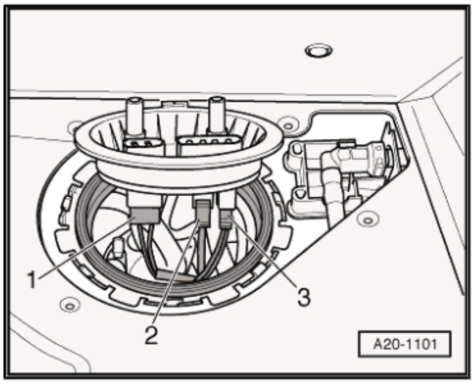
Vehicles with FSI engine:

- Working through right fuel tank opening, fit fuel lines -1- and -2- going to fuel delivery units so that they engage audibly.

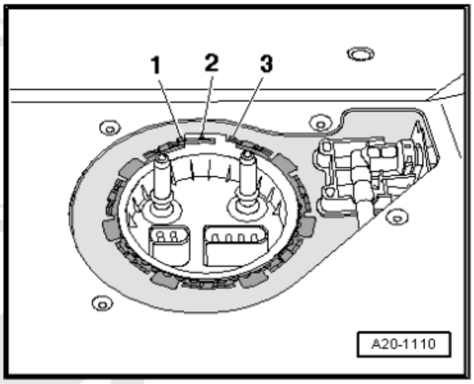


All vehicles (continued):

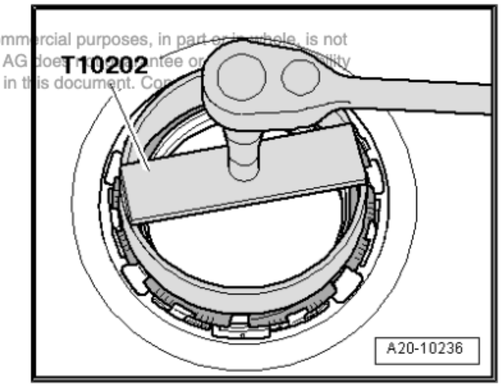
- Connect electrical connectors -1 ... 3- on underside of flange (right-side).
- Install new seal for flange (seal must be installed dry).



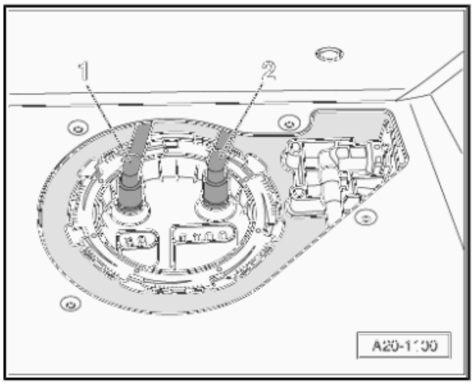
- Fit flange into fuel tank; note correct installation position:
- Lug -2- on flange must be between tabs -1- and -3- on fuel tank.



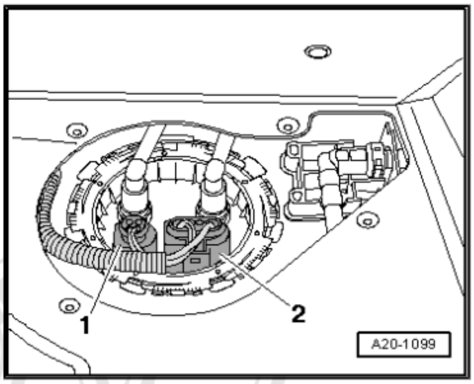
- Tighten locking ring.



– Install fuel supply line -2- and fuel return line -1- (as marked) so that they engage audibly.

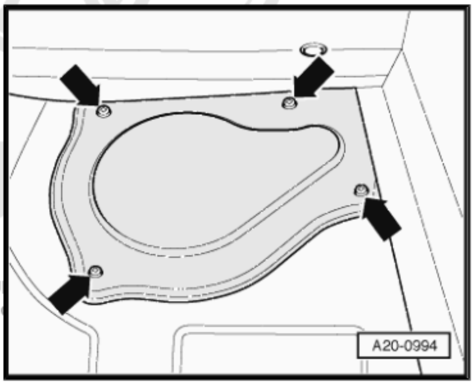


– Attach electrical connectors -1- and -2- on flange (right-side).



– Secure cover for flange (right-side) -arrows-.

– Connect battery. Observe notes on procedures required after connecting battery ⇒ Electrical system; Rep. gr. 27 .



13 Fuel filter - all vehicles

⇒ “13.1 Fuel filter on vehicles without auxiliary heater - exploded view”, page 239

⇒ “13.2 Removing and installing fuel filter on vehicles without auxiliary heater”, page 240

⇒ “13.3 Fuel filter on vehicles with auxiliary heater - exploded view”, page 240

⇒ “13.4 Removing and installing fuel filter on vehicles with auxiliary heater”, page 241

⇒ “13.5 Fuel filter on vehicles with fuel system without fuel return line - exploded view”, page 242

⇒ “13.6 Removing and installing fuel filter on vehicles with fuel system without fuel return line”, page 243

13.1 Fuel filter on vehicles without auxiliary heater - exploded view

1 - Fuel return line
  - ☐ From engine
  - ☐ Clipped onto fuel filter bracket
  - ☐ Press release tab on connection piece to disconnect

2 - Fuel filter
  - ☐ Flow direction is marked by arrows
  - ☐ Do not interchange connections
  - ☐ Removing and installing ⇒ page 240

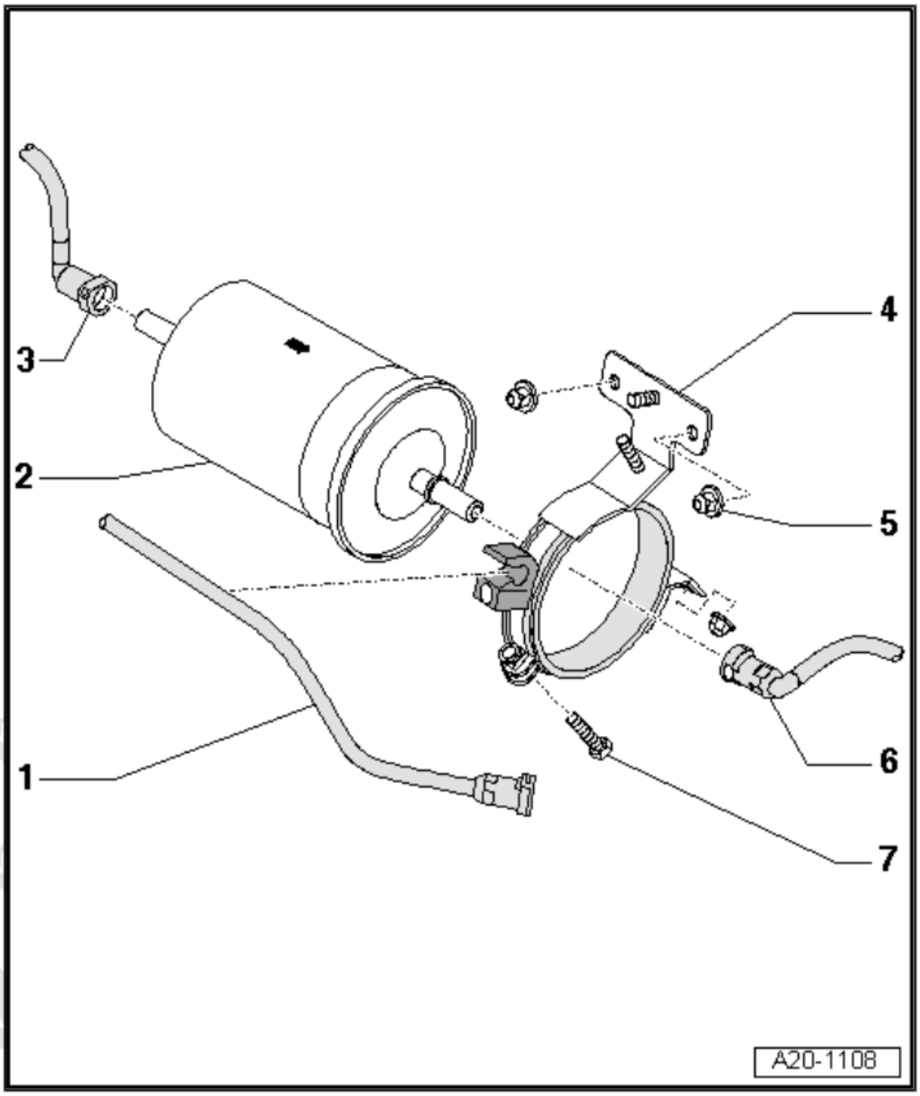
3 - Fuel supply line
  - ☐ From fuel tank
  - ☐ Press release tab on connection piece to disconnect

4 - Bracket for fuel filter

5 - 1.5 Nm

6 - Fuel supply line
  - ☐ To engine
  - ☐ Press release tab on connection piece to disconnect

7 - 3 Nm



13.2 Removing and installing fuel filter on vehicles without auxiliary heater

Special tools and workshop equipment required

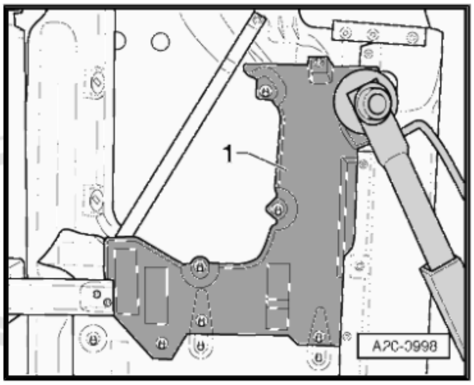
- Drip tray

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

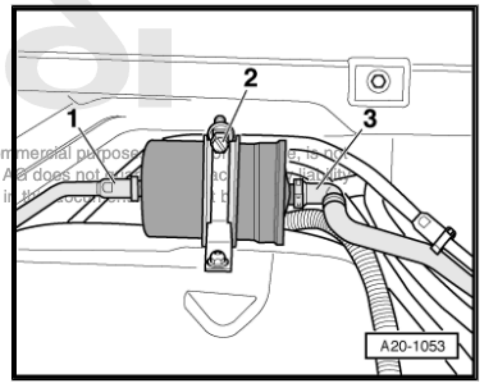
– Remove cover -1- from underside of vehicle (right-side).



– Place drip tray under fuel filter.

WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.



– Disconnect fuel pipes -1- and -3- by pressing the release tabs.

– Remove bolt -2-.

– Remove fuel filter.

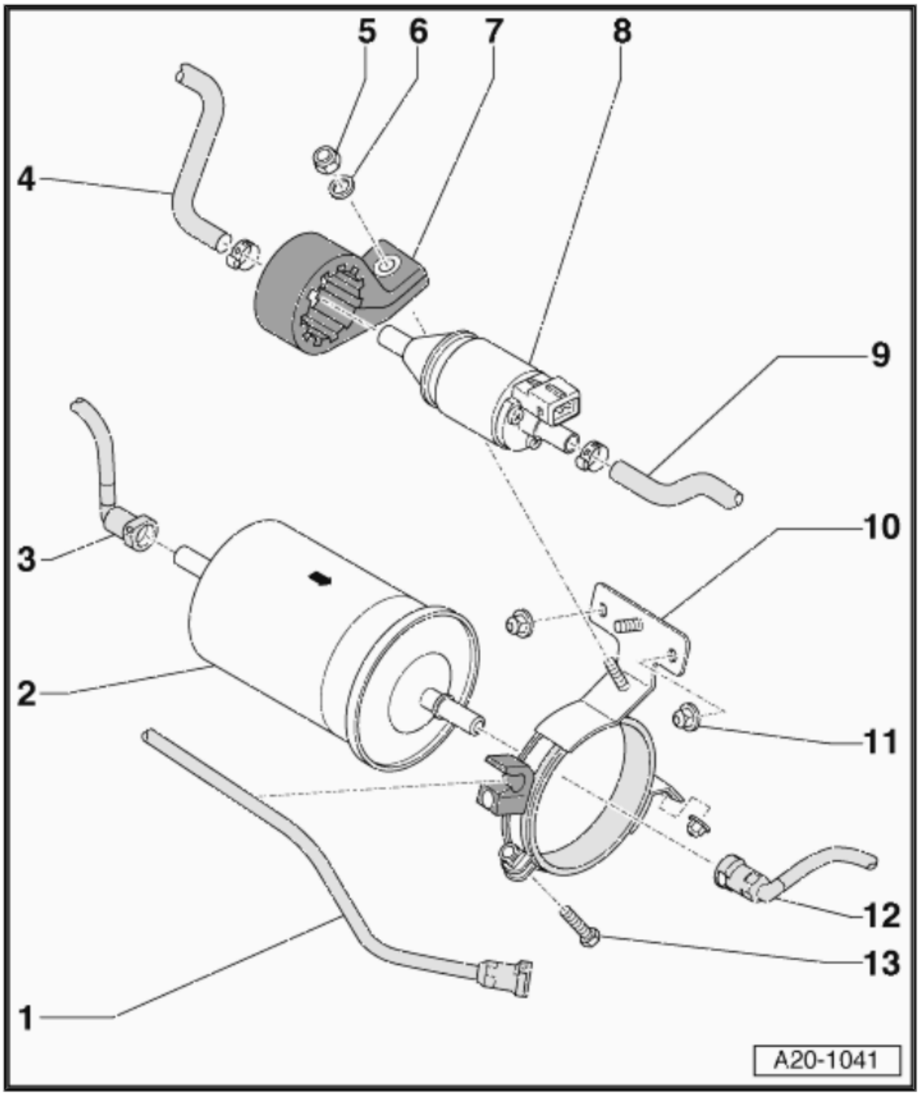
Installing

- Tightening torque ⇒ page 239

Installation is carried out in the reverse order; note the following:

- Flow direction is marked by arrows

13.3 Fuel filter on vehicles with auxiliary heater - exploded view



1 - Fuel return line

- ❑ From engine
- ❑ Clipped onto fuel filter bracket
- ❑ Press release tab on connection piece to disconnect

2 - Fuel filter

- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Removing and installing ⇒ page 241

3 - Fuel supply line

- ❑ From fuel tank
- ❑ Press release tab on connection piece to disconnect

4 - Fuel supply line

- ❑ To metering pump for auxiliary heater

5 - 10 Nm

- ❑ Self-locking
- ❑ Renew

6 - Washer

7 - Retainer

- ❑ For metering pump for auxiliary heater

8 - Metering pump for auxiliary heater

- ❑ Secure with retainer -item 7- to bracket -item 10-

9 - Fuel supply line

- ❑ To auxiliary heater

10 - Bracket for fuel filter

11 - 1.5 Nm

12 - Fuel supply line

- ❑ To engine
- ❑ Press release tab on connection piece to disconnect

13 - 3 Nm

13.4 Removing and installing fuel filter on vehicles with auxiliary heater

Special tools and workshop equipment required

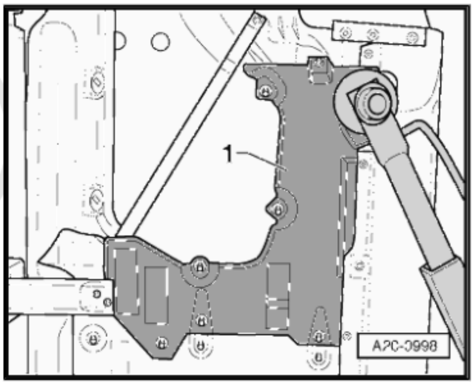
- ♦ Drip tray

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

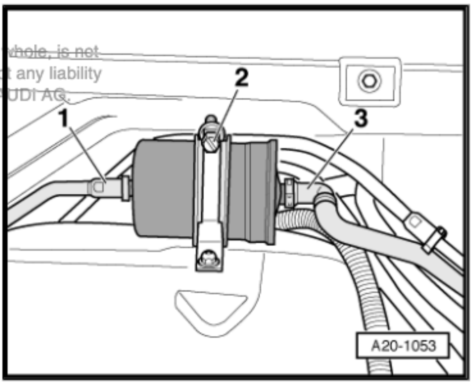
– Remove cover -1- from underside of vehicle (right-side).



– Place drip tray under fuel filter.

WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.



– Disconnect fuel pipes -1- and -3- by pressing the release tabs.

– Remove bolt -2-.

– Remove fuel filter.

Installing

- Tightening torque ⇒ page 240

Installation is carried out in the reverse order; note the following:

- Flow direction is marked by arrows

13.5 Fuel filter on vehicles with fuel system without fuel return line - exploded view

1 - Fuel filter with pressure control valve, 4 bar

- ☐ Flow direction is marked by arrows
- ☐ Do not interchange connections
- ☐ Removing and installing ⇒ page 243

2 - Fuel supply line

- ☐ From fuel tank
- ☐ Press release tab on connection piece to disconnect

3 - Fuel return line

- ☐ To fuel tank
- ☐ Press release tab on connection piece to disconnect

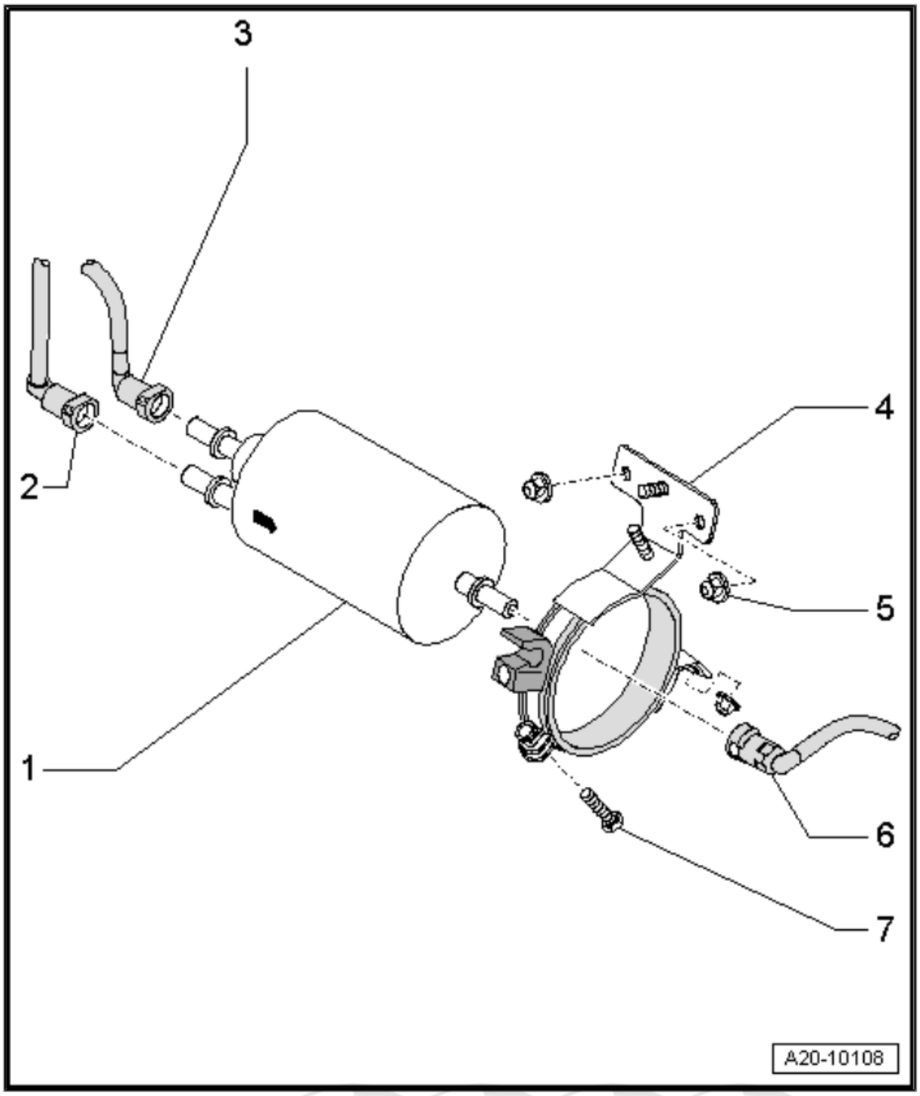
4 - Bracket for fuel filter

5 - 1.5 Nm

6 - Fuel line

- ☐ To engine
- ☐ Press release tab on connection piece to disconnect

7 - 3 Nm



13.6 Removing and installing fuel filter on vehicles with fuel system without fuel return line

Special tools and workshop equipment required

- ◆ Drip tray

Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove cover -1- from underside of vehicle (right-side).

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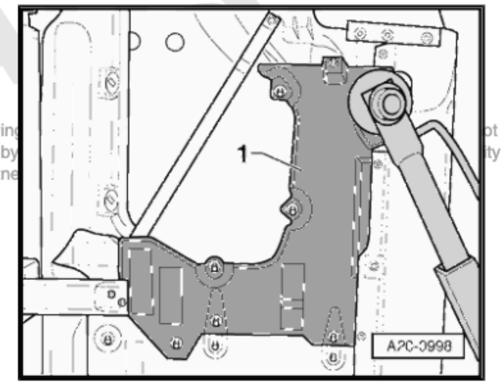
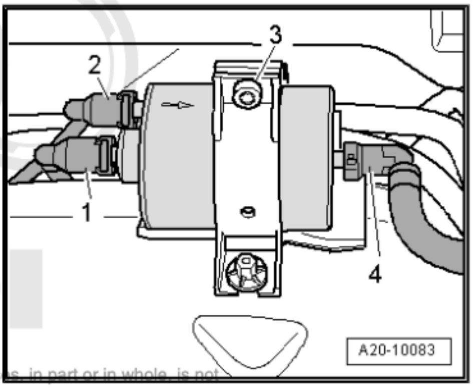


- Place drip tray under fuel filter.

WARNING

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then release pressure by carefully loosening the connection.



- Disconnect fuel pipes -1-, -2- and -4- by pressing the release tabs.
- Remove bolt -3-.
- Remove fuel filter.

Installing

- Tightening torque ⇒ page 242 .

Installation is carried out in the reverse order; note the following:

- Flow direction is marked by arrows

14 Activated charcoal filter system - rest-of-world vehicles

⇒ “14.1 Activated charcoal filter system - exploded view”, page 245

⇒ “14.2 Removing and installing activated charcoal filter”, page 245

14.1 Activated charcoal filter system - exploded view

1 - Activated charcoal filter

2 - Breather line
  - ☐ To fuel tank

3 - 10 Nm

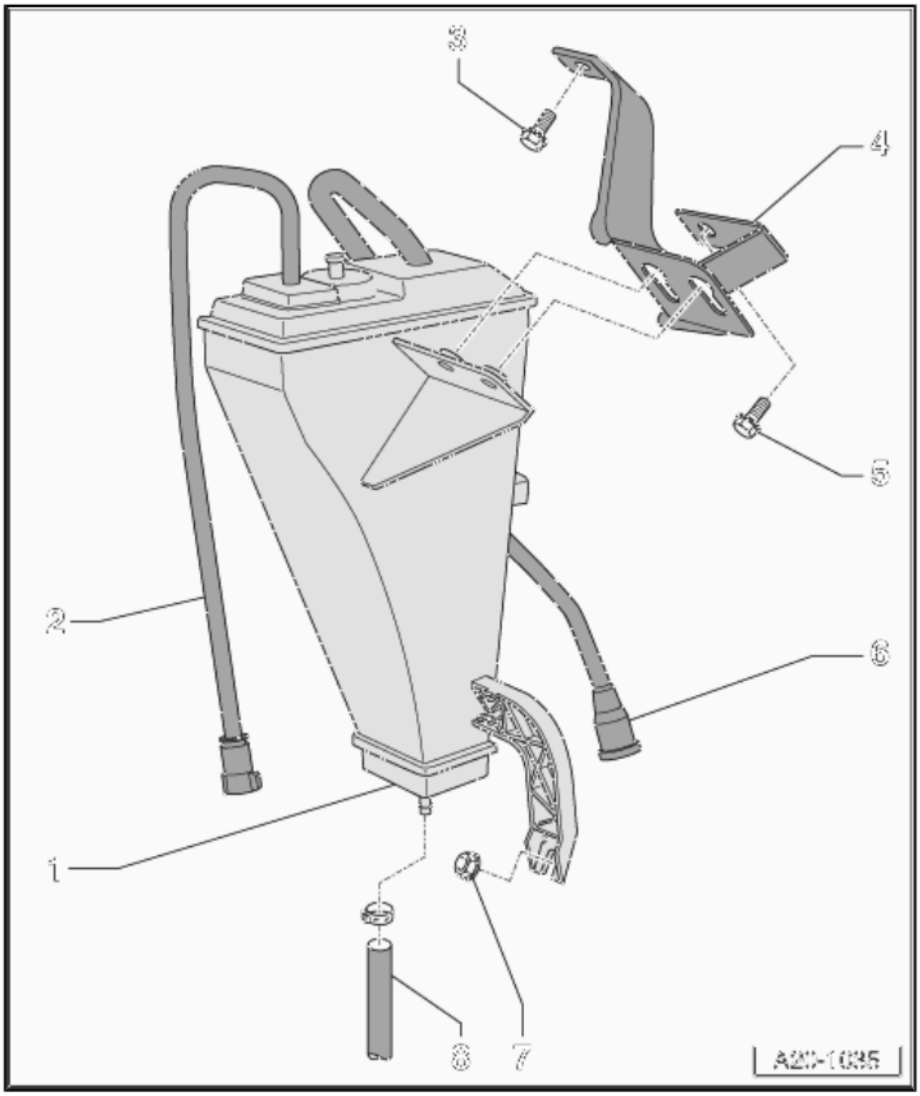
4 - Bracket

5 - 10 Nm

6 - Breather line
  - ☐ To activated charcoal filter solenoid valve 1 -N80-

7 - 10 Nm

8 - Hose
  - ☐ Open to atmosphere at rear of vehicle (centre)



14.2 Removing and installing activated charcoal filter

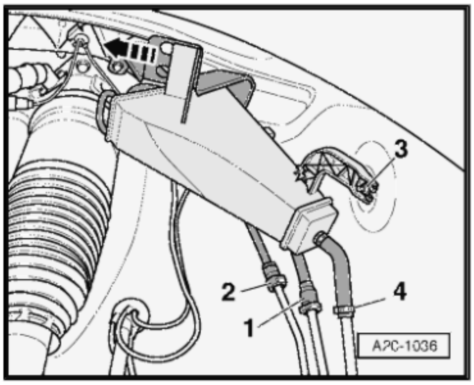
Removing

Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

– Remove rear wheel (left-side).

– Remove rear left wheel housing liner ⇒ Rep. gr. 66 .



- Disconnect breather lines -1- and -2- by pressing release tabs.
- Detach breather pipe -4-.
- Unscrew nut -3- and detach activated charcoal filter at top mounting -arrow-.
- Remove activated charcoal filter with breather pipes.

Installing

- Tightening torque ⇒ page 245

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Attach activated charcoal filter at top mounting.
- Secure activated charcoal filter to wheel housing.
- Install rear left wheel housing liner ⇒ Rep. gr. 66 .

15 Activated charcoal filter system - USA vehicles

⇒ “15.1 Activated charcoal filter system - exploded view”, page 247

⇒ “15.2 Removing and installing activated charcoal filter”, page 248

⇒ “15.3 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 8-cylinder and 10-cylinder engines”, page 249

⇒ “15.4 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 12-cylinder engine”, page 251

⇒ “15.5 Tank leak diagnostic system”, page 251

⇒ “15.6 Performing tank leak diagnosis”, page 252

⇒ “15.7 Fuel system diagnostic pump V144 - exploded view”, page 253

⇒ “15.8 Removing and installing fuel system diagnostic pump V144 ”, page 254

⇒ “15.9 Removing and installing activated charcoal filter solenoid valve 2 N115 ”, page 255

15.1 Activated charcoal filter system - exploded view

1 - Cover for activated charcoal filter

2 - Breather line

- To activated charcoal filter solenoid valve 1 - N80-

3 - Breather line

- To fuel tank

4 - Activated charcoal filter

- Fitting location: at bottom of spare wheel well on underbody

5 - Connecting hose

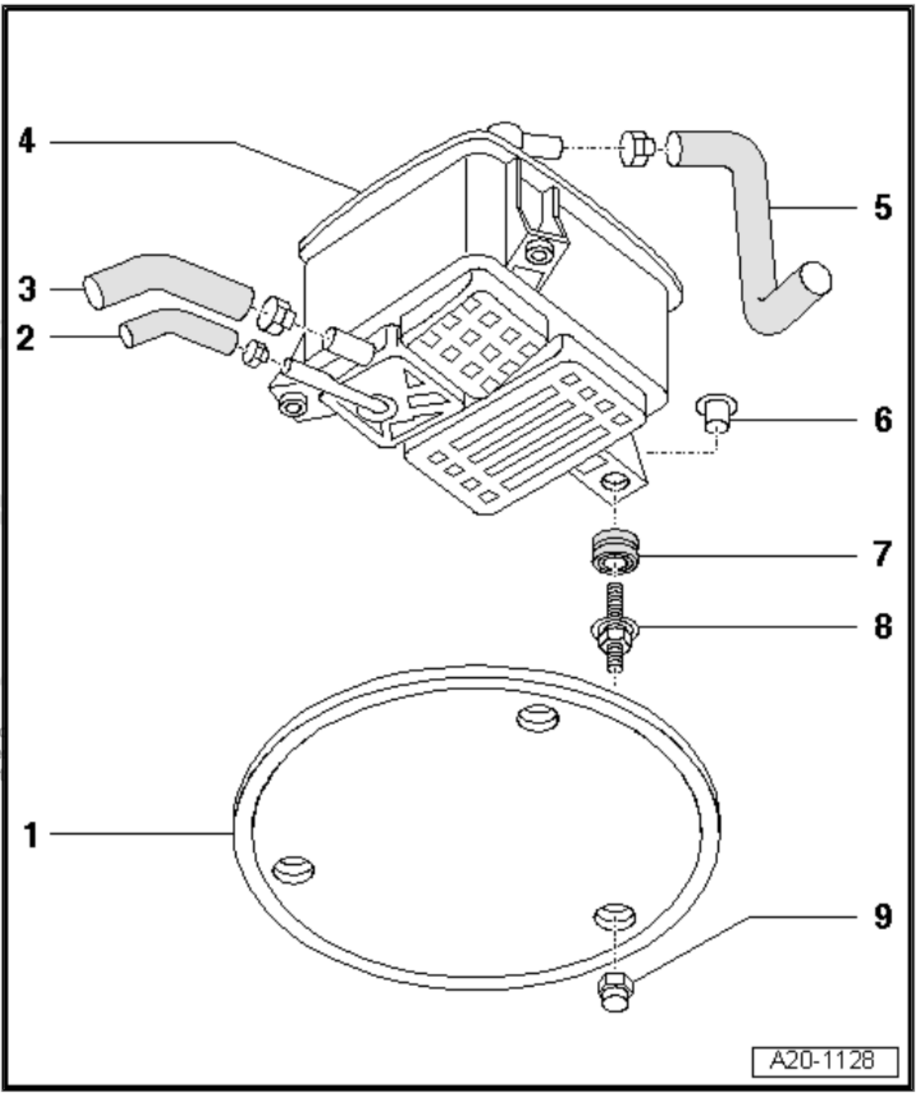
- Diagnostic pump / activated charcoal filter

6 - Bush

7 - Rubber grommet

8 - Stud, 16 Nm

9 - Cap nut, 9 Nm



15.2 Removing and installing activated charcoal filter

Note

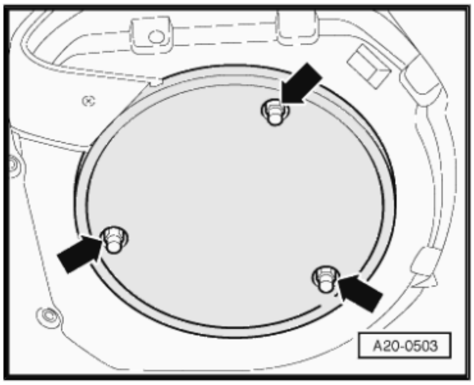
Checking for leaks
⇒ “15.6 Performing tank leak diagnosis”, page 252

Removing

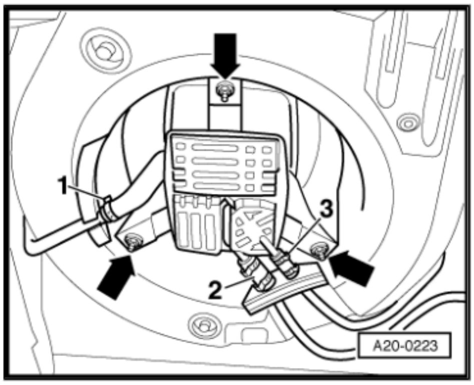
Observe safety precautions ⇒ page 1 .

Observe rules for cleanliness ⇒ page 3 .

- Unscrew cover for activated charcoal filter at underside of spare wheel well -arrows-.



- Detach hose connections -1 ... 3- from breather pipes.
- Unscrew studs -arrows- and remove activated charcoal filter.



Installing

- Tightening torques ⇒ page 247

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

15.3 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 8-cylinder and 10-cylinder engines

1 - Throttle valve module - J338-

2 - Activated charcoal filter solenoid valve 1 - N80-

- ☐ Fitting location: in engine compartment

3 - Breather line

- ☐ From activated charcoal filter to activated charcoal filter solenoid valve 1 - N80-
- ☐ Installation position: on underside of vehicle (right-side)

4 - Breather line

- ☐ To fuel tank

5 - Activated charcoal filter

- ☐ Fitting location: at bottom of spare wheel well on underbody

6 - Connecting hose

- ☐ Diagnostic pump / activated charcoal filter
- ☐ Pressure side

7 - Activated charcoal filter solenoid valve 2 - N115-

- ☐ Fitting location: in rear left wheel housing beneath liner

8 - Fuel system diagnostic pump - V144-

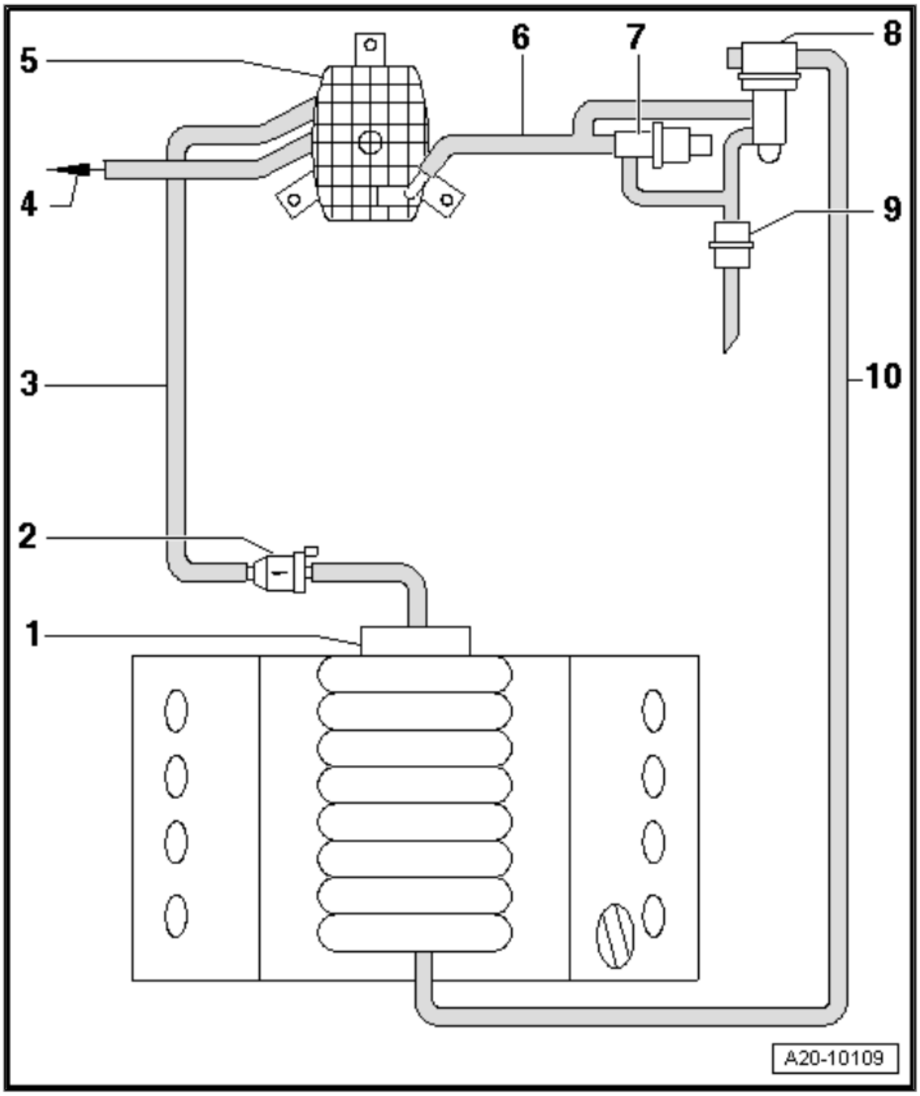
- ☐ Vacuum-driven
- ☐ Fitting location: in rear left wheel housing beneath liner

9 - Air filter for diagnostic pump

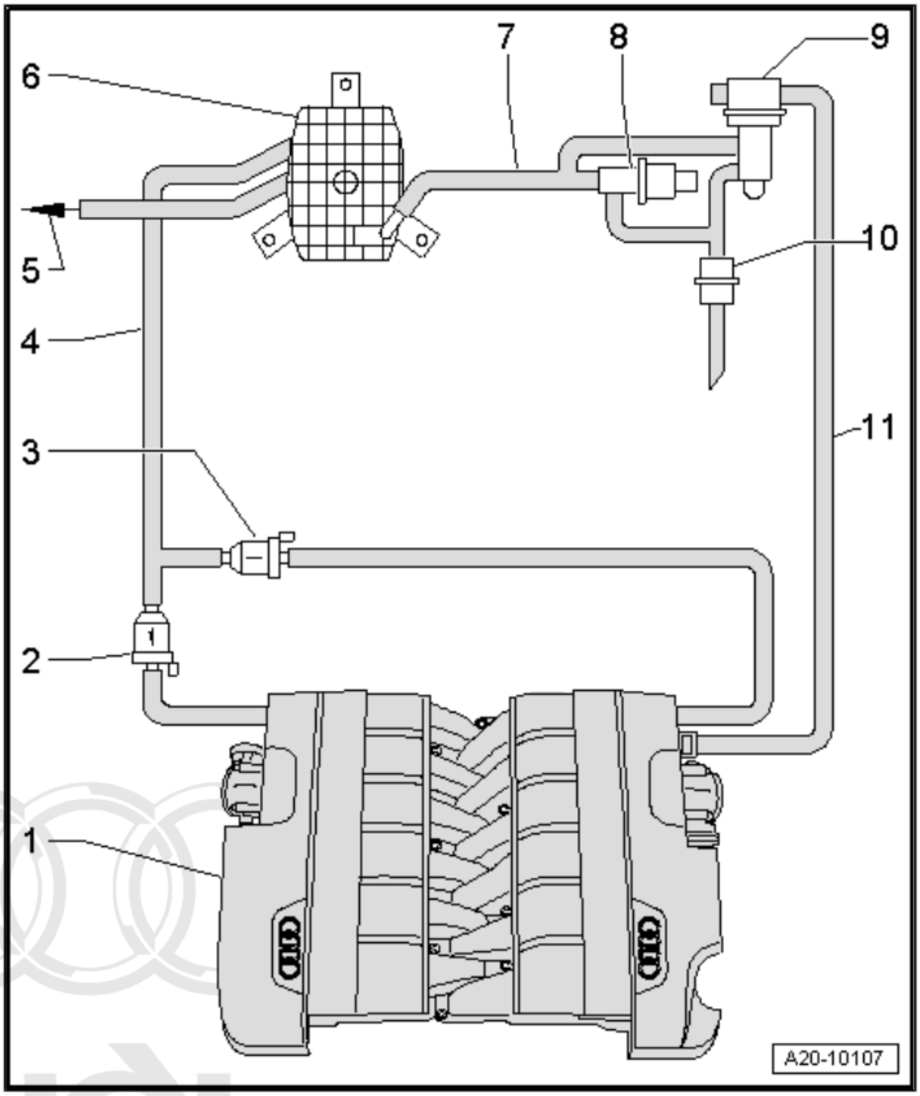
- ☐ Installation position: arrow on filter housing points to diagnostic pump -item 8-

10 - Vacuum line

- ☐ Supplies diagnostic pump with vacuum from intake manifold



15.4 Routing of pipes/hoses for activated charcoal filter system with tank leak diagnostic system - vehicles with 12-cylinder engine



1 - Intake manifold

2 - Activated charcoal filter solenoid valve 1 - N80-
  - ☐ Fitting location: in engine compartment

3 - Activated charcoal filter system solenoid valve 2 - N333-
  - ☐ Fitting location: in engine compartment

4 - Breather line
  - ☐ From activated charcoal filter to solenoid valves for activated charcoal filter in engine compartment
  - ☐ Installation position: on underside of vehicle (right-side)

5 - Breather line
  - ☐ To fuel tank

6 - Activated charcoal filter
  - ☐ Fitting location: at bottom of spare wheel well on underbody

7 - Connecting hose
  - ☐ Diagnostic pump / activated charcoal filter
  - ☐ Pressure side

8 - Activated charcoal filter solenoid valve 2 - N115-
  - ☐ Fitting location: in rear left wheel housing beneath liner

9 - Fuel system diagnostic pump - V144-
  - ☐ Vacuum-driven
  - ☐ Fitting location: in rear left wheel housing beneath liner

10 - Air filter for diagnostic pump
  - ☐ Installation position: arrow on filter housing points to diagnostic pump -item 9-

11 - Vacuum line
  - ☐ Supplies diagnostic pump with vacuum from intake manifold

15.5 Tank leak diagnostic system

How the system works

The tank leak diagnostic system detects leaks in the complete fuel system, including fuel tank, activated charcoal filter and activated charcoal filter solenoid valve 1 - N80- .

The mechanical components of the tank leak diagnostic system consist primarily of a vacuum-driven diaphragm pump, with a reed contact located on the operating rod of the pump diaphragm. The vacuum required is supplied to the pump from the engine intake.

- ◆ The diaphragm pump delivers a pressure of 20 ... 30 mbar to the fuel system when the tank leak diagnostic system starts up. In this condition the pump diaphragm is extended, so the reed contact located on the operating rod is in the “open” position.
- ◆ The diagnostic system detects whether the reed contact remains open for 10 seconds. In this case the fuel system is free of leaks.

- ◆ If the pressure drops (indicating a leak), the diaphragm returns and the reed contact closes.
- ◆ If the reed contact closes within 10 seconds, a further test is performed. The diaphragm pump is then activated for another 4 strokes. For each of these strokes the engine control unit measures the period of time it takes for the reed contact to close again after pressure delivery. In this way the control unit can distinguish between a “small leak” (smaller than 1 mm diameter) and a “large leak”.

The diagnosis is activated automatically shortly after every engine start. If a fault is detected, the fault is stored in the fault memory. A fault message is displayed in the instrument cluster if the fault is detected during two consecutive road trips. The diagnosis function can also be activated with the vehicle diagnostic tester ⇒ page 252 .

Automatic tank leak diagnosis

The engine control unit performs a tank leak diagnosis at regular intervals when the engine is running.

15.6 Performing tank leak diagnosis

Check the fuel tank leak diagnosis system using the “Guided Fault Finding” function ⇒ Vehicle diagnostic tester.

Checking fuel tank system and tank breather system for leaks

Note

The following locations/components must be checked when checking the fuel tank system and tank breather system for leaks. Initiate a tank leak diagnosis after eliminating a suspected leak to make sure the diagnosed leak has been eliminated.

- – Switch off ignition.
- – Check whether the filler cap of the fuel tank was properly closed when performing the diagnosis.
- – Check whether the seal of the filler cap is damaged or deformed. Renew if necessary.
- – Remove luggage compartment floor covering.
- – Detach covers for flanges on fuel tank (left and right sides).

Note

Observe notes on re-installing flanges: left-side ⇒ page 75 , right-side ⇒ page 86 .

- – Check that the seals under the fuel tank flanges are undamaged and that the locking rings on the flanges are properly tightened. Also check whether the fuel lines are connected properly.

- Perform a visual check on all pipe/hose connections of the fuel tank system and renew leaking pipes/hoses, e.g.:

- Pipe between activated charcoal filter and activated charcoal filter solenoid valve 1 - N80- / activated charcoal filter system solenoid valve 2 - N333- (in engine compartment).
- Pipes from activated charcoal filter to diagnostic pump for fuel system - V144- / activated charcoal filter solenoid valve 2 - N115- .
- Pipe between fuel tank and activated charcoal filter (behind cover for activated charcoal filter).
- Fuel lines to engine

Note

Leaks in pipes and components of the fuel tank system can sometimes be detected by applying a non-flammable, environment-friendly leak detecting spray. Initiate a tank leak diagnosis repeatedly to build up pressure in the system. Bubbles will form at the leak.

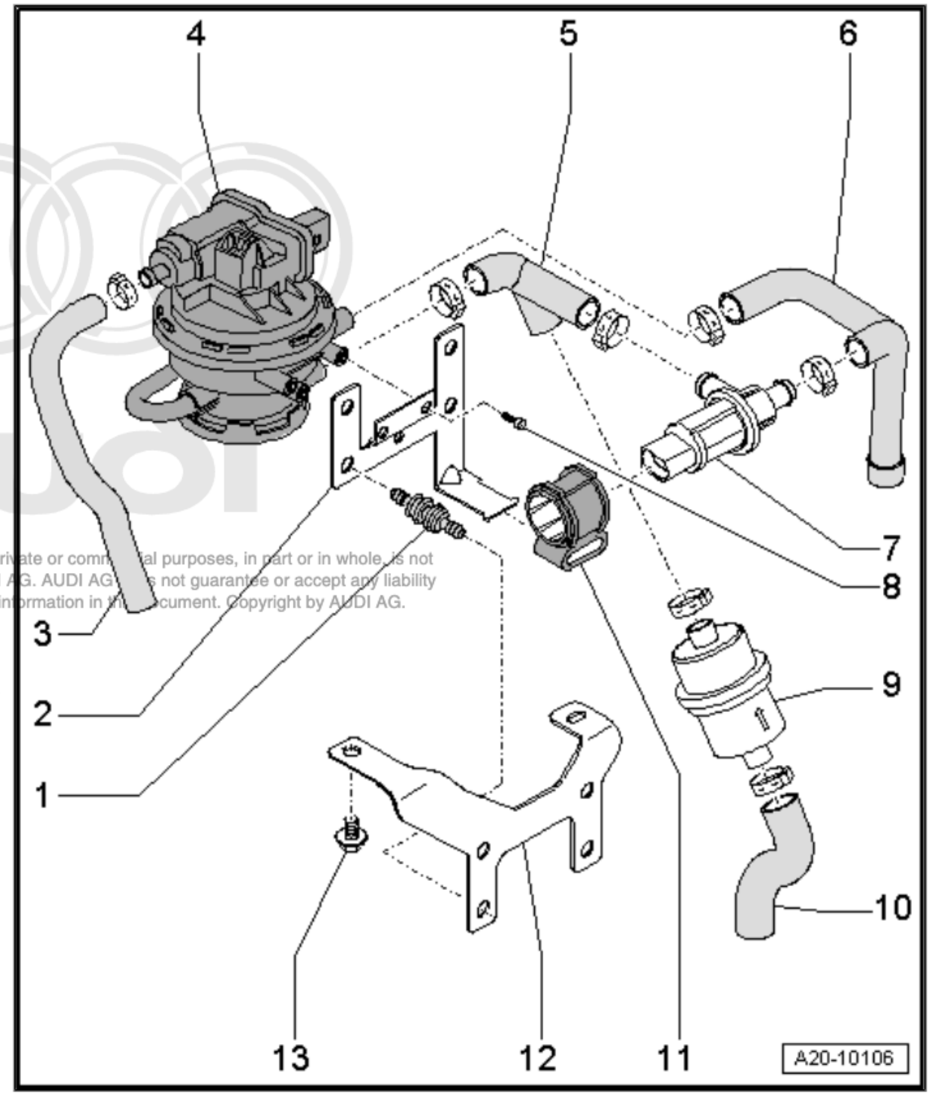
- Perform a visual check on the components of the fuel tank system/fuel tank breather system:

- Fuel tank
- Activated charcoal filter
- Fuel system diagnostic pump - V144-
- Activated charcoal filter solenoid valve 1 - N80-
- Activated charcoal filter solenoid valve 2 - N115-
- Activated charcoal filter system solenoid valve 2 - N333-

Note

Due to the shape or function of these components it is not always possible to detect leaks by applying leak detecting spray. If this is the case, clamp off hoses going to the respective component using hose clamps up to 25 mm - 3094- and initiate tank leak diagnosis. If no leak is then found after clamping off the hoses, the corresponding component is defective. If the hoses are clamped off directly at the diagnostic pump and a leak is still indicated, there is a leak in the diagnostic pump itself.

15.7 Fuel system diagnostic pump - V144- - exploded view



1 - Retaining peg

2 - Bracket for diagnostic pump

3 - Vacuum line
  - ☐ To intake manifold (front)

4 - Fuel system diagnostic pump - V144-
  - ☐ Fitting location: in rear left wheel housing beneath liner
  - ☐ Checking in “Guided Fault Finding” ⇒ Vehicle diagnostic tester
  - ☐ Removing and installing ⇒ page 254

5 - Elbow hose with branch

6 - Elbow hose with branch
  - ☐ To activated charcoal filter

7 - Activated charcoal filter solenoid valve 2 - N115-
  - ☐ Checking in “Guided Fault Finding” ⇒ Vehicle diagnostic tester
  - ☐ Removing and installing ⇒ page 255

8 - 1.2 Nm

9 - Air filter for diagnostic pump

10 - Hose

11 - Retainer
  - ☐ For activated charcoal filter solenoid valve 2 - N115-

12 - Bracket
  - ☐ To body

13 - 9 Nm

15.8 Removing and installing fuel system diagnostic pump - V144-

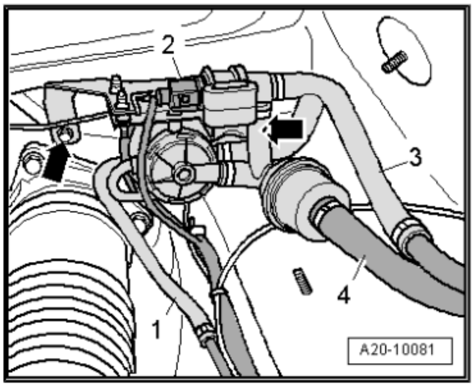
Removing

– Switch off ignition.

– Remove rear wheel (left-side).

– Remove rear left wheel housing liner ⇒ Rep. gr. 66 .

- Detach hose connections -1-, -3- and -4-.
- Unplug electrical connector -2- at activated charcoal filter solenoid valve 2 - N115- .
- Unscrew securing bolts -arrows-.
- Detach fuel system diagnostic pump - V144- and disconnect electrical connector.
- Detach diagnostic pump from bracket.



Installing

- Tightening torques ⇒ page 253

Installation is carried out in the reverse order; note the following:

Note

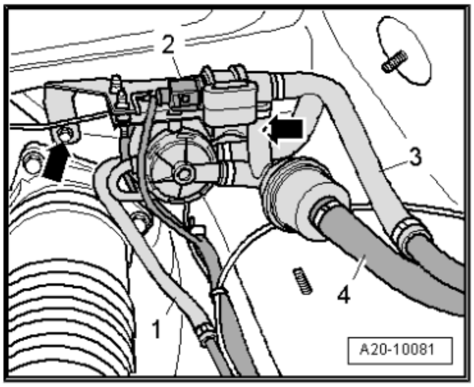
Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Install rear left wheel housing liner ⇒ Rep. gr. 66 .

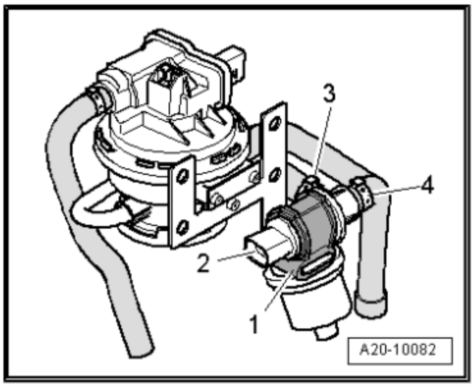
15.9 Removing and installing activated charcoal filter solenoid valve 2 - N115-

Removing

- Switch off ignition.
- Remove rear wheel (left-side).
- Remove rear left wheel housing liner ⇒ Rep. gr. 66 .
- Disconnect hose connections -1-, -3- and -4-.
- Unplug electrical connector -2- at activated charcoal filter solenoid valve 2 - N115- .



- Detach vacuum hoses -3- and -4- from activated charcoal filter solenoid valve 2 - N115- -item 2-.
- Detach solenoid valve from mounting -1-.



Installing

- Tightening torque ⇒ page 253

Installation is carried out in the reverse order; note the following:

Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

- Install rear left wheel housing liner ⇒ Rep. gr. 66 .

16 Accelerator mechanism - all vehicles

⇒ “16.1 Accelerator mechanism - exploded view”, page 256

⇒ “16.2 Removing and installing accelerator pedal module with accelerator position sender”, page 257

⇒ “16.3 Removing and installing kickdown switch F8 ”, page 257

16.1 Accelerator mechanism - exploded view

Note

There is a separate kickdown switch - F8- installed in vehicles with automatic gearbox. Removing and installing kickdown switch - F8- ⇒ page 257 .

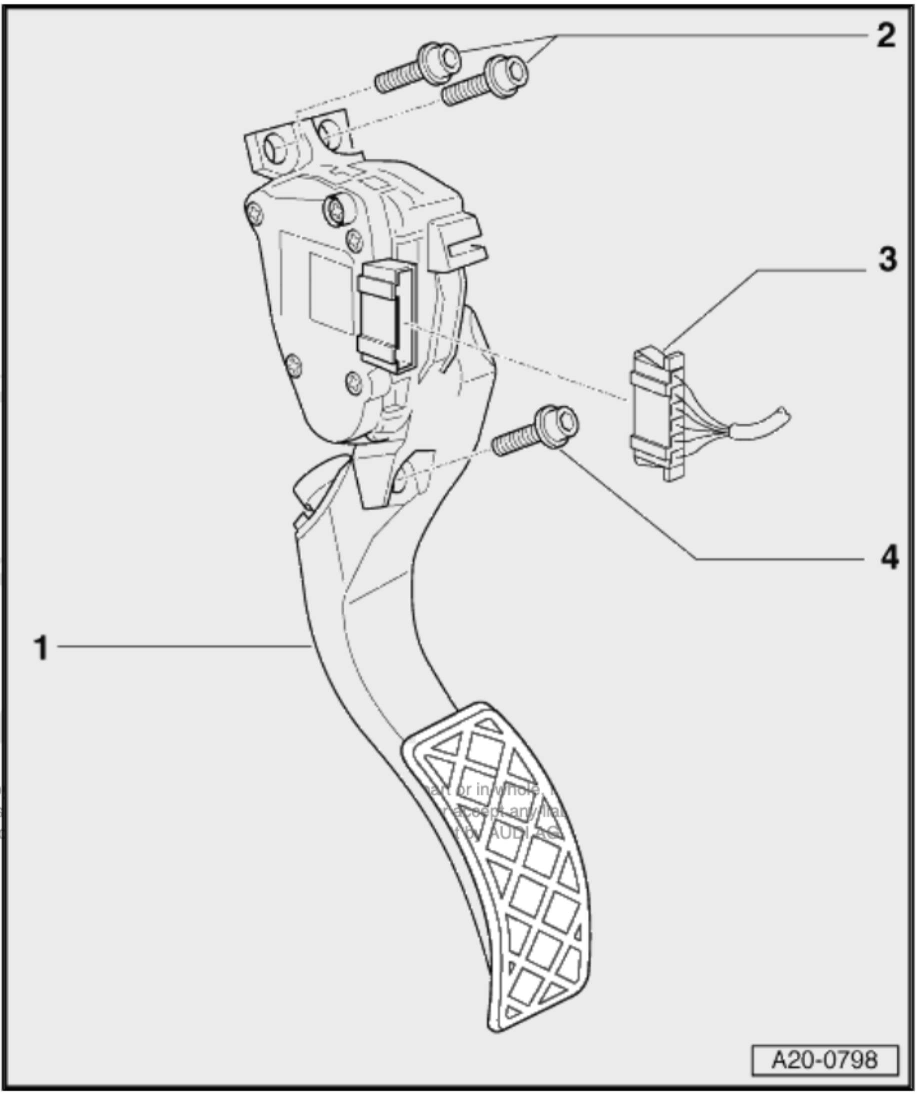
1 - Accelerator pedal module

- ❑ With accelerator position sender - G79- and accelerator position sender 2 - G185-
- ❑ Removing and installing ⇒ page 257

2 - 10 Nm

3 - Electrical connector

4 - 10 Nm



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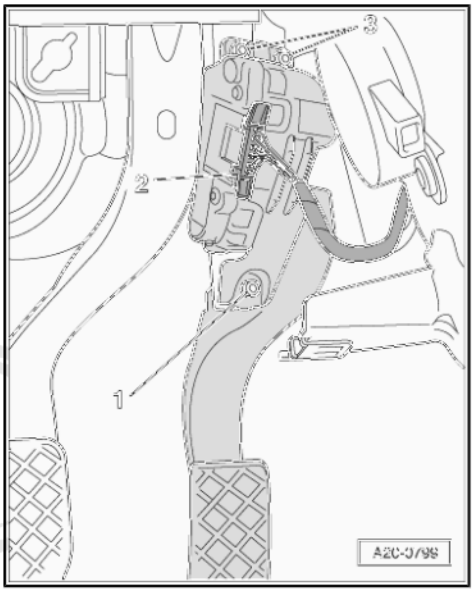
16.2 Removing and installing accelerator pedal module with accelerator position sender

Removing

- Remove storage compartment on driver's side ⇒ Rep. gr. 68 .
- Unplug electrical connector -2-.
- Remove bolts -1- and -3-.
- Remove accelerator pedal module.



Installing

- Tightening torque ⇒ page 256

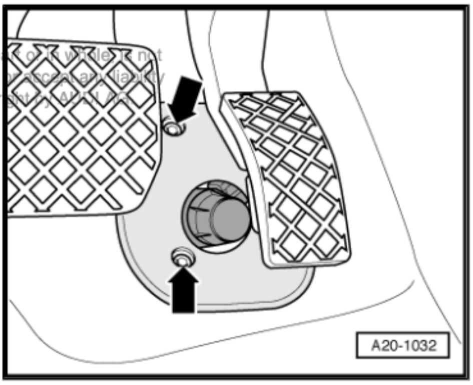
Installation is carried out in the reverse order; note the following:

- Install storage compartment on driver's side ⇒ Rep. gr. 68 .

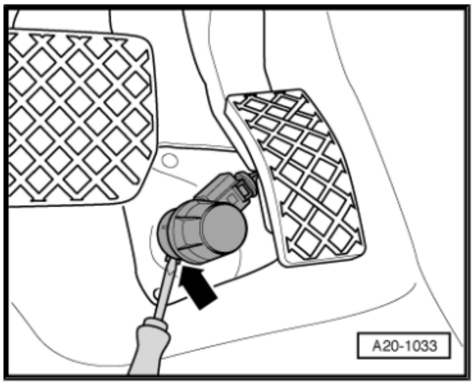
16.3 Removing and installing kickdown switch - F8-

Removing

- Use screwdriver to prise off cover caps.
- Unscrew bolts -arrows- and remove cover for kickdown switch.



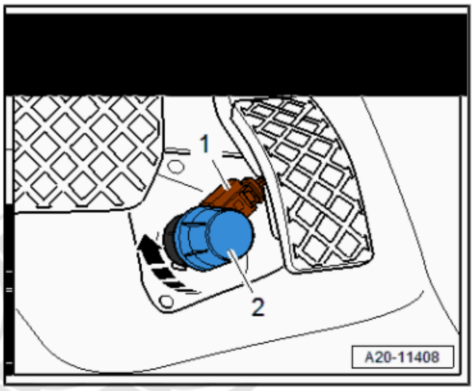
- Use a small screwdriver to release retainer tab -arrow- and turn kickdown switch anti-clockwise.
- Unplug electrical connector.



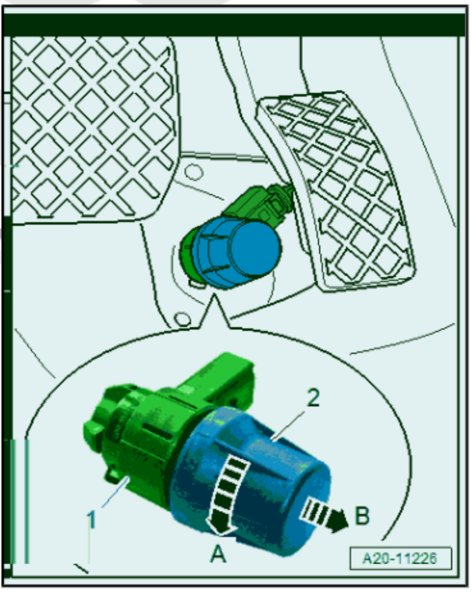
Installing

Installation is carried out in the reverse order; note the following:

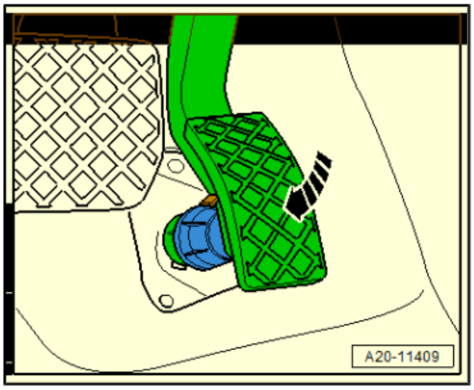
- Connect electrical connector -1- on kickdown switch - F8- .
- Insert kickdown switch in mounting on vehicle floor and engage by turning clockwise -arrow-.



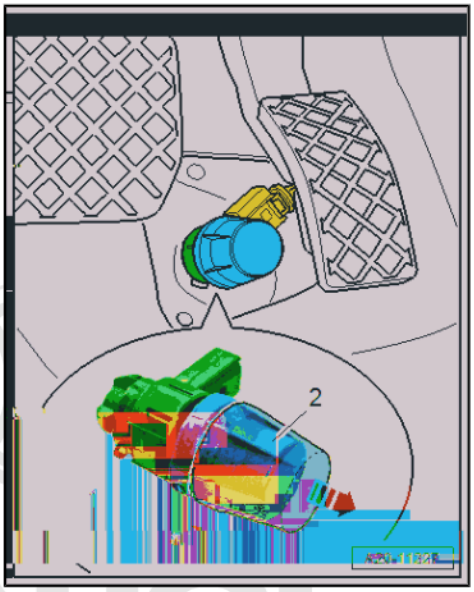
- Disengage cap -2- of kickdown switch -1-; to do so turn cap anti-clockwise -arrow A-. Pull cap out as far as stop -arrow B-.



- Press accelerator pedal down as far as stop -arrow- and release again.



- Pull cap -2- of kickdown switch -1- outwards by distance -a- -arrow-.
- Distance -a- = 5 mm.



- Lock cap -2- of kickdown switch -1- in place by turning cap 15° in clockwise direction -arrow- as far as stop.

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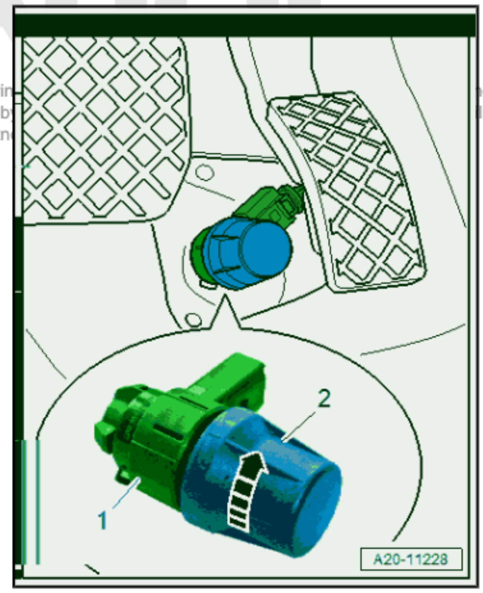
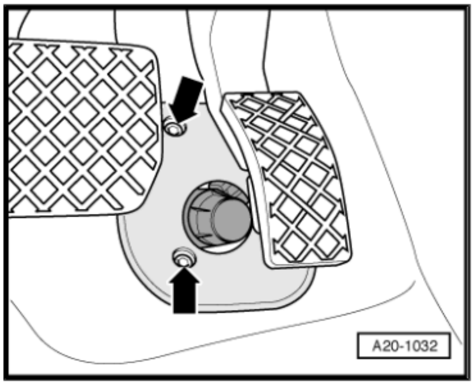


- Fit cover -arrows-.
- Perform a test drive and check that kickdown switch -F8- is functioning correctly.



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28 - Ignition system . . . 40

- 1 Checking ignition system . . . 40
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- 1.3 Technical data . . . 40

24 – Mixture preparation - injection

1 Servicing motronic injection system

1.1 Safety measures

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- If you want to crank engine at starting speed without actually starting it (for example, in order to test compression pressure), first unplug connectors from ignition coils and also from injectors.
- Certain tests may lead to a fault being detected by the control unit and stored. Therefore, interrogate and, if necessary, delete the fault memory after all repairs and tests.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

Caution

The fuel system is pressurised. Before opening the system place a cloth around the connection. Then dissipate pressure by carefully unfastening the connection.

Note the following if testers and measuring instruments have to be used during a road test:

Caution

- *Test equipment must always be secured on the rear seat and operated from that position by a second person.*
- *If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, the person sitting in this seat could be seriously injured when the airbag is triggered.*

1.2 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following “6 rules”:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- Carefully cover or seal opened components if repairs are not to be performed immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).

- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.
- Unplugged electrical connectors; keep them clean and dry. Make sure connections are dry when attaching.

1.3 Technical data

Engine code letters		ASN (3.0 ltr. / 5V /162 kW engine)	BBJ (3.0 ltr. / 5V / 160 kW engine)
Idling speed Cannot be adjusted; regulated by idling speed stabilisation		700 ... 800 rpm 1)	700 ... 800 rpm 1)
Speed governing by deactivation of fuel injectors		approx. 6800 rpm	approx. 6800 rpm
Fuel pressure at idling speed	Vacuum hose connected	3.2 … 3.8 bar	3.2 … 3.8 bar
	Vacuum hose disconnected	3.8 … 4.2 bar	3.8 … 4.2 bar
Residual pressure after 10 minutes	Engine cold	approx. 2.2 bar	approx. 2.2 bar
Residual pressure after 10 minutes		approx. 3.0 bar	approx. 3.0 bar
Fuel injectors	Spray pattern	Two-hole nozzle / same for all injectors	Two-hole nozzle / same for all injectors
	Injection quantity (30 s)	90 ... 125 ml	90 ... 125 ml
	Resistance (room temperature)	11 … 13 Ω	11 … 13 Ω

1) Depending on engine oil temperature / gearbox oil temperature an engine speed increase up to 980 rpm is possible.

1.4 Overview - fitting locations

Note!

The illustration does not show the electric fuel pump II relay -J49- . Fitting location ⇒ page 8 .

1 - Solenoid valve 1 for activated charcoal filter -N80-
  - ☐ Fitting location ⇒ page 10

2 - Fuel pump relay -J17-
  - ☐ Fitting location ⇒ page 7

3 - Hall sender 3 -G300-
  - ☐ for exhaust camshaft bank 1
  - ☐ Fitting location ⇒ page 11

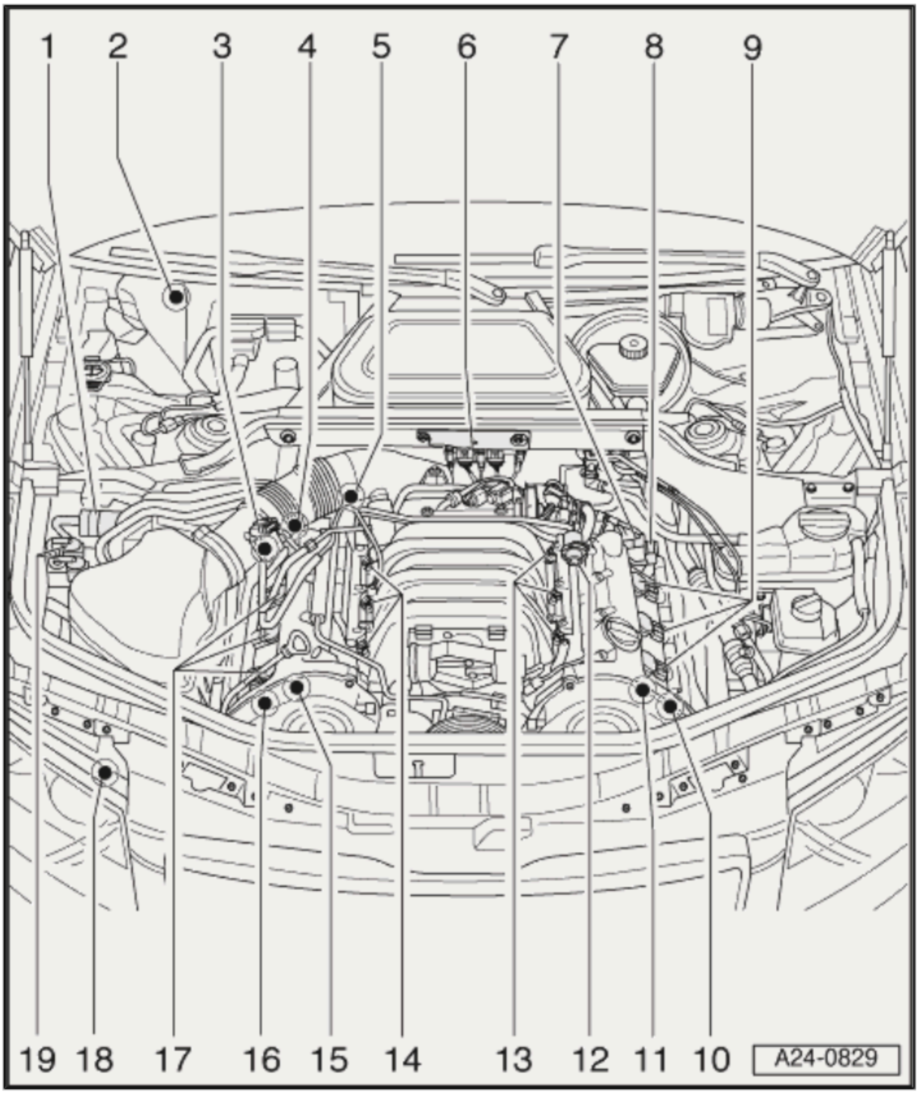
4 - Coolant temperature sender -G62-
  - ☐ Fitting location ⇒ page 11

5 - Hall sender -G40-
  - ☐ for inlet camshaft bank 1
  - ☐ Fitting location ⇒ page 11

6 - Bracket for connectors - rear centre
  - ☐ Assignment ⇒ page 9

7 - Hall sender 2 -G163-
  - ☐ for inlet camshaft bank 2
  - ☐ Fitting location ⇒ page 11

8 - Hall sender 4 -G301-
  - ☐ for exhaust camshaft bank 2
  - ☐ Fitting location ⇒ page 11



9 - Ignition coils with output stages, bank 2
  - ☐ Cylinder 4 ignition coil 4 with output stage -N292-
  - ☐ Cylinder 5 ignition coil 5 with output stage -N323-
  - ☐ Cylinder 6 ignition coil 6 with output stage -N324-

10 - Valve 2 for camshaft adjustment, exhaust -N319-
  - ☐ Bank 2

11 - Valve 2 for camshaft adjustment -N208-
  - ☐ Bank 2

12 - Fuel pressure regulator
  - ☐ Checking ⇒ page 23

13 - Injectors, bank 2
  - ☐ Cylinder 4 injector, cylinder 4 -N33-
  - ☐ Cylinder 5 injector, cylinder 5 -N83-
  - ☐ Cylinder 6 injector, cylinder 6 -N84-
  - ☐ Checking injection quantity and spray pattern; checking for leaks ⇒ page 30
  - ☐ Removing and installing ⇒ page 28

14 - Injectors, bank 1
  - ☐ Cylinder 1 injector, cylinder 1 -N30-

- ☐ Cylinder 2 injector, cylinder 2 -N31-
- ☐ Cylinder 3 injector, cylinder 3 -N32-
- ☐ Checking injection quantity and spray pattern; checking for leaks ⇒ page 30
- ☐ Removing and installing ⇒ page 28

15 - Valve 1 for camshaft adjustment, inlet -N205-

- ☐ Bank 1

16 - Valve 1 for camshaft adjustment, exhaust -N318-

- ☐ Bank 1

17 - Ignition coils with output stages, bank 1

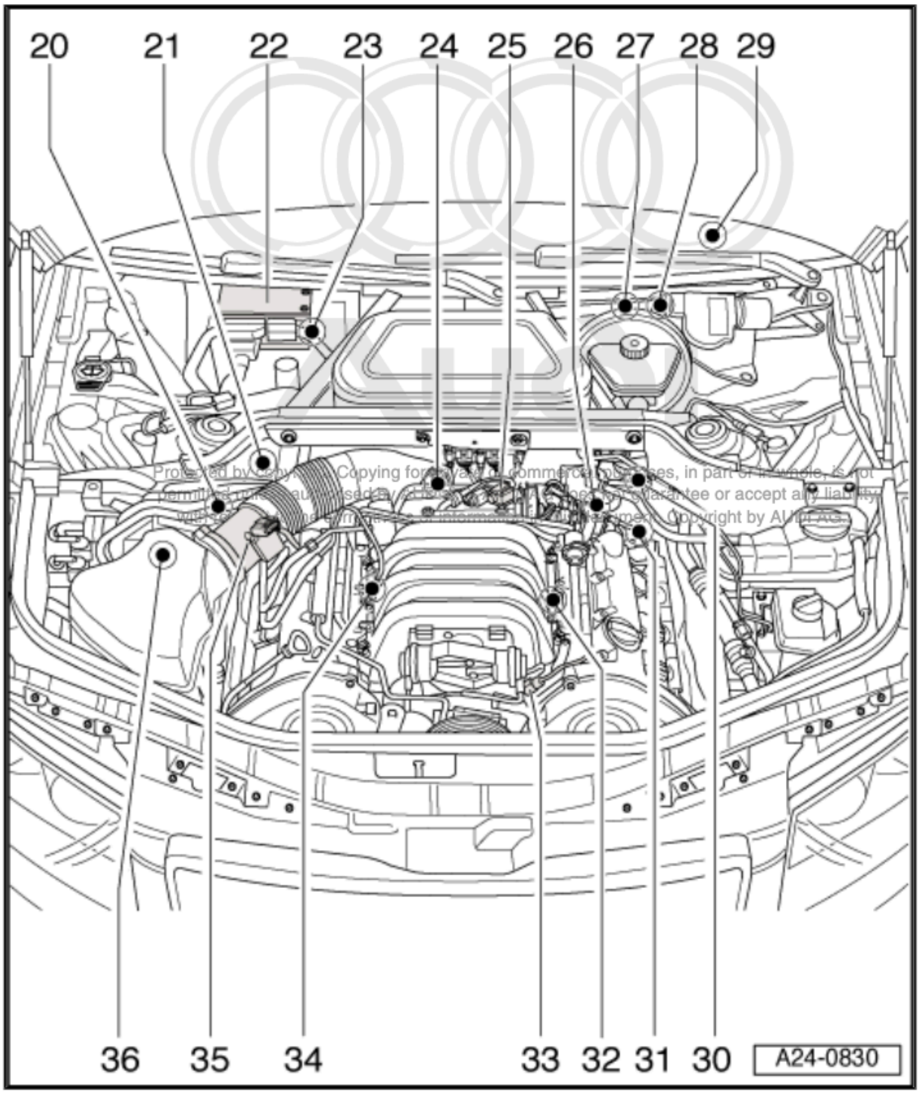
- ☐ Cylinder 1 ignition coil 1 with output stage -N70-
- ☐ Cylinder 2 ignition coil 2 with output stage -N127-
- ☐ Cylinder 3 ignition coil 3 with output stage -N291-

18 - Secondary air pump motor -V101-

- ☐ Fitting location ⇒ page 10

19 - Bracket for connectors - right side of vehicle

- ☐ Assignment ⇒ page 8



20 - Lambda probe, before catalytic converter -G39- with Lambda probe heater -Z19-

- ☐ Bank 1, probe 1
- ☐ Continuous-action Lambda probe
- ☐ Fitting location ⇒ page 9
- ☐ Removing and installing ⇒ page 32

21 - Lambda probe, after catalytic converter -G130- with Lambda probe heater 1, after catalytic converter -Z29-

- ☐ Bank 1, probe 2
- ☐ Two-state Lambda probe
- ☐ Fitting location ⇒ page 9
- ☐ Removing and installing ⇒ page 35

22 - Engine control unit -J623-

- ☐ Fitting location ⇒ page 8
- ☐ Removing and installing ⇒ page 21

23 - Electronics box, plenum chamber

- ☐ Fitting location for secondary air pump relay -J299- , Motronic current supply relay -J271- and secondary air pump fuse -S130- (50 amp) ⇒ page 8

24 - Throttle valve module -J338-

- ☐ Including throttle valve drive (electric throttle operation) -G186- , angle sender for throttle valve drive -G187- and angle sender 2 for throttle valve drive -G188-

25 - Secondary air inlet valve -N112-

- ☐ Fitting location ⇒ page 10

26 - Engine speed sender -G28-

- ☐ Fitting location ⇒ page 9

27 - Accelerator pedal sender -G79- and accelerator pedal sender 2 -G185-

Fitting location ⇒ page 7

28 - Brake light switch -F- and brake pedal switch -F47-

- ☐ Fitting location ⇒ page 7

29 - Instrument cluster

- ☐ Fitting location for exhaust emissions warning lamp -K83- ⇒ page 6 and electronic power control fault lamp -K132- (EPC lamp) ⇒ page 6

30 - Lambda probe 2, after catalytic converter -G131- with Lambda probe heater 2, after catalytic converter -Z30-

- ☐ Bank 2, probe 2
- ☐ Two-state Lambda probe
- ☐ Fitting location ⇒ page 9
- ☐ Removing and installing ⇒ page 37

31 - Lambda probe 2, before catalytic converter -G108- with Lambda probe heater 2 -Z28-

- ☐ Bank 2, probe 1
- ☐ Continuous-action Lambda probe
- ☐ Fitting location ⇒ page 9
- ☐ Removing and installing ⇒ page 32

32 - Knock sensor II -G66-

- ☐ Bank 2
- ☐ Beneath intake manifold

33 - Intake manifold change-over valve -N156-

- ☐ Fitting location ⇒ page 10

34 - Knock sensor I -G61-

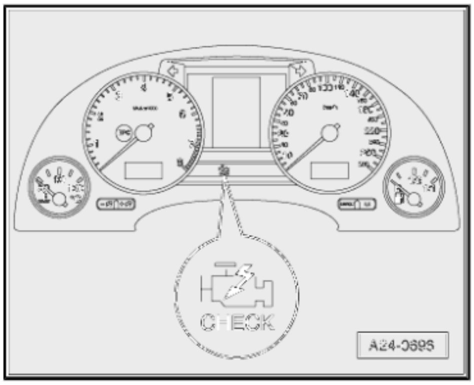
- ☐ Bank 1

35 - Air mass meter -G70- with intake air temperature sender -G42-

36 - Earth connection

- ☐ On longitudinal member (right-side)

Fitting location of exhaust emissions warning lamp -K83-



- In instrument cluster.

Function

After switching on the ignition the engine control unit switches on the exhaust emissions warning lamp -K83- . Shortly after engine is started, the exhaust emissions warning lamp -K83- goes out if engine control unit has not recognised any faults detrimental to the emission values and there is also no problem with actuation of the lamp by the engine control unit.

Fault messages

If faults which cause the exhaust emissions to deteriorate are detected when the engine is on, the engine control unit switches on the exhaust emissions warning lamp -K83- , which will then either flash or light up constantly. At the same time a fault code is stored in the fault memory of the engine control unit.

If lamp stays lit:

A fault detrimental to emissions has occurred. The fault memory of the engine control unit has to be interrogated.

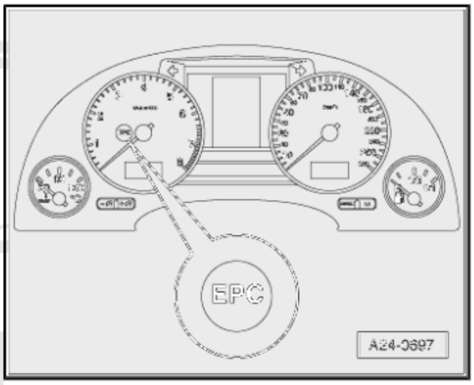
If lamp flashes:

A fault has occurred which, under these driving conditions, will cause damage to the catalytic converter (e.g. misfiring). In this case the vehicle may only be driven with reduced power.

Note!

Fault memory must be interrogated in the event of engine running problems or a customer complaint, even if exhaust emissions warning lamp -K83- does not light up. The fault memory may include faults which do not activate the exhaust emissions warning lamp immediately, but only if fault is detected again following the next engine start.

Fitting location of electronic power control fault lamp -K132- (EPC lamp)



- In instrument cluster.

"EPC" is the abbreviation for "Electronic Power Control".

After switching on the ignition the engine control unit switches on the electronic power control fault lamp -K132- . Shortly after engine is started, the electronic power control fault lamp -K132- goes out if engine control unit has not recognised any faults in EPC system and there is also no problem with actuation of the lamp by the engine control unit.

If a fault is detected in the EPC system while the engine is running, the engine control unit switches on the electronic power control fault lamp -K132- (EPC lamp). At the same time a fault code is stored in the fault memory of the engine control unit.

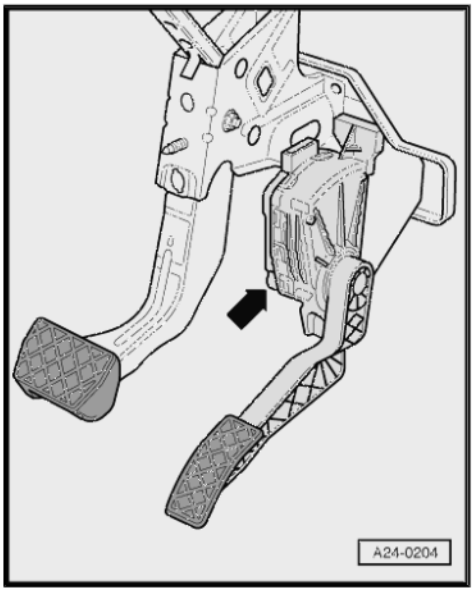
Fitting location of accelerator pedal sender -G79- and accelerator pedal sender 2 -G185-

- Integrated in accelerator pedal module -arrow-.

Note!

- *Diagram shows set-up on left-hand drive vehicles.*
- *The accelerator pedal position sender -G79- and accelerator pedal position sender -2- -G185- are integrated in the accelerator pedal module and cannot be renewed individually.*

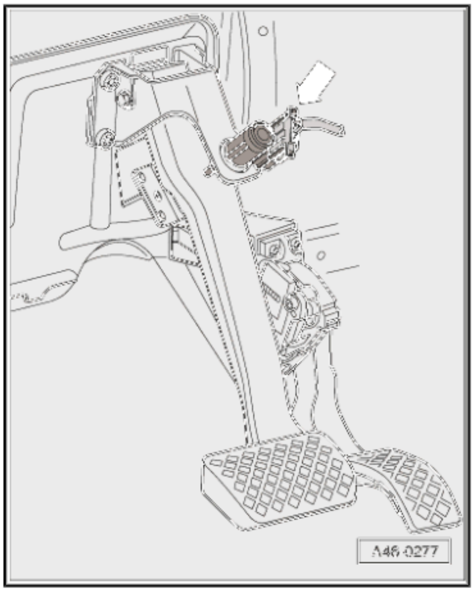
Removing and installing accelerator pedal module ⇒ Fuel supply system, petrol engines; Rep. Gr. 20 .



Fitting location of brake light switch -F- and brake pedal switch -F47-

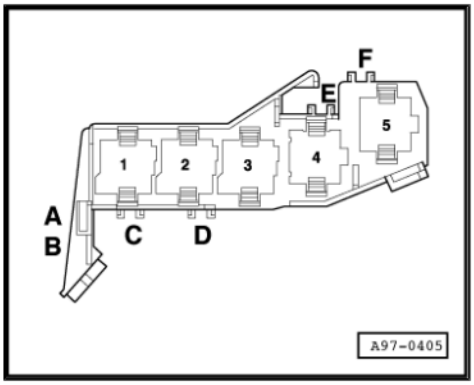
- On pedal bracket -arrow-.

Removing and installing switch ⇒ Brake system; Rep. Gr. 46 .



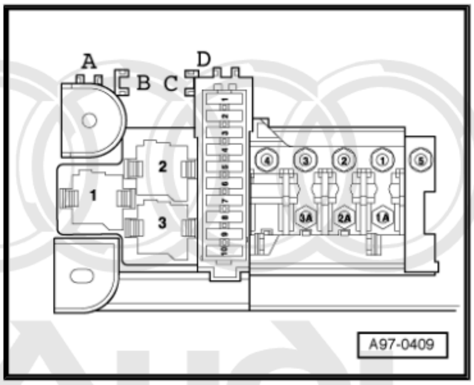
Fitting location of fuel pump relay -J17-

- On relay carrier in front passenger's footwell, position -4-.



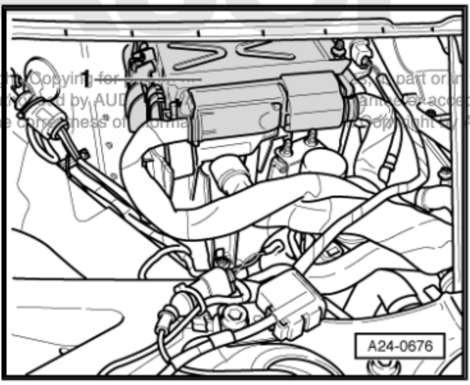
Fitting location of electric fuel pump II relay -J49-

- ◆ On relay and fuse carrier on right side of boot, position -3-.



Fitting location of engine control unit -J623-

- ◆ The engine control unit -J623- -Item 1- is located on top of electronics box at plenum chamber.

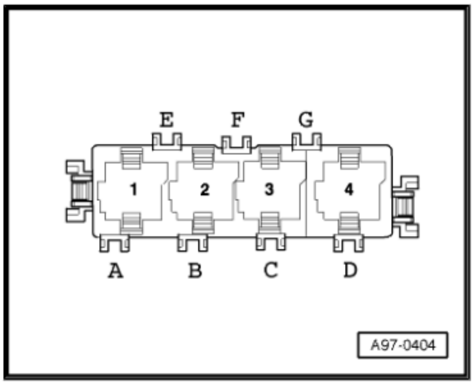


Fitting locations in electronics box (plenum chamber).

1 - Secondary air pump relay -J299-

3 - Motronic current supply relay -J271-

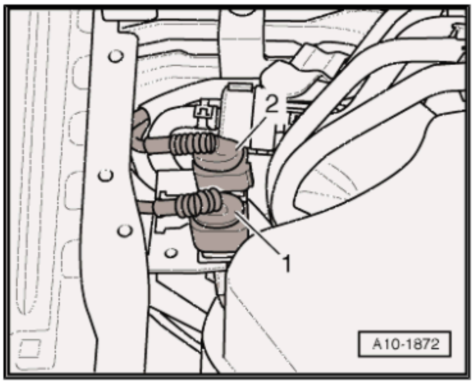
B - Secondary air pump relay -S130- (50 amp)



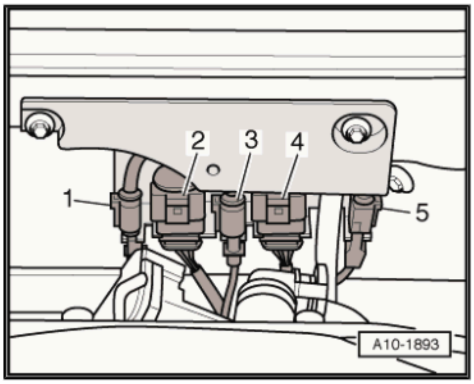
Coonector allocation on bracket - right side of vehicle

1 - Electrical connector (dark brown) for Lambda probe -G39- (before catalytic converter) and Lambda probe heater -Z19-

2 - Electrical connector (black) for Lambda probe II -G108- (before catalytic converter) and Lambda probe heater 2 -Z28-



Connector allocation on bracket - rear centre



1 - Electrical connector (blue) for knock sensor I -G61-

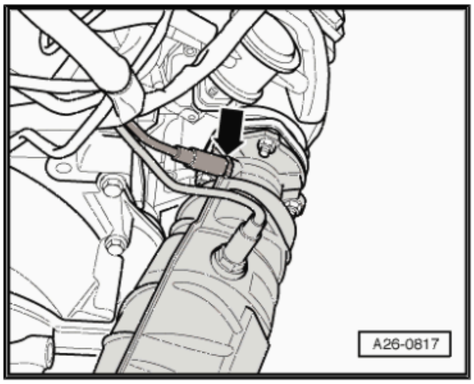
2 - Electrical connector (green) for Lambda probe after catalytic converter -G130- and Lambda probe 1 heater, after catalytic converter -Z29-

3 - Electrical connector (grey) for engine speed sender -G28-

4 - Electrical connector (brown) for Lambda probe II after catalytic converter -G131- and Lambda probe 2 heater, after catalytic converter -Z30-

5 - Electrical connector (blue) for knock sensor II -G66-

Fitting location of Lambda probes before catalytic converter

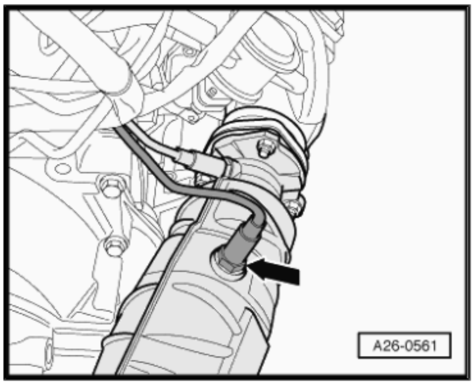


- In front exhaust pipe -arrow-.

Note!

The illustration shows the Lambda probe -G39- for cylinder bank 1 (right-side).

Fitting location of Lambda probes after catalytic converter

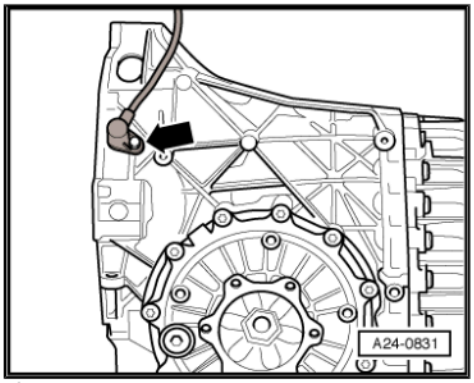


- In catalytic converter -arrow-.

Note!

The illustration shows the Lambda probe after catalytic converter -G130- for cylinder bank 1 (right-side).

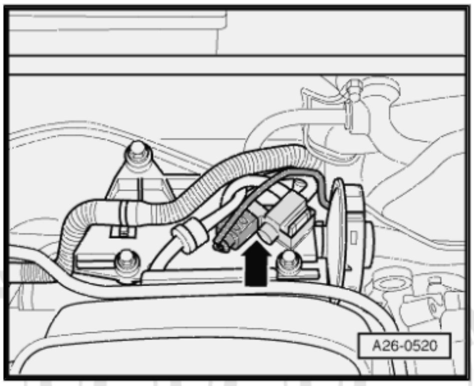
Fitting location of engine speed sender -G28-



- On top left of gearbox housing -arrow-.

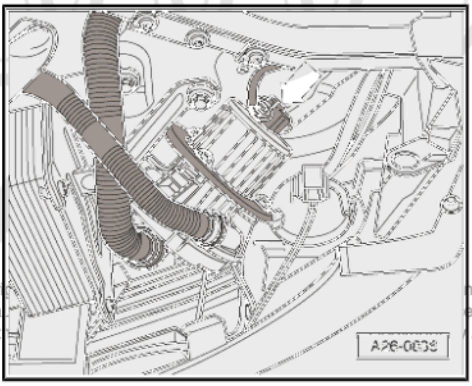
Fitting location of secondary air inlet valve -N112-

- ◆ Inserted on retainer plate for solenoid valves at rear of engine -arrow-.



Fitting location of secondary air pump motor -V101-

- ◆ On bottom right of longitudinal member -arrow-.



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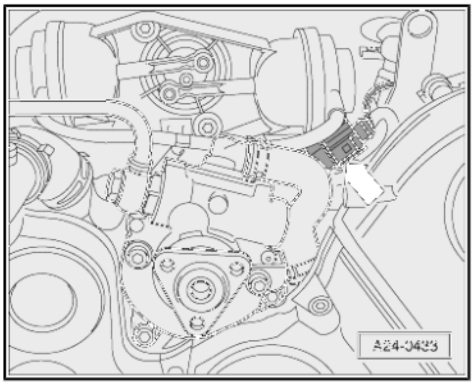
Fitting location of intake manifold change-over valve -N156-

- ◆ Clipped onto vacuum unit at front of intake manifold -arrow-.

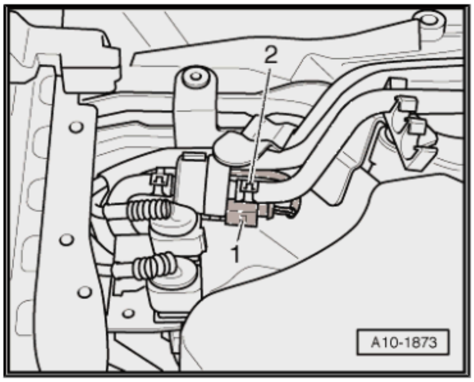


Fitting location of activated charcoal filter system solenoid valve I -N80-

- ◆ At rear right in engine compartment.

1 - Electrical connector

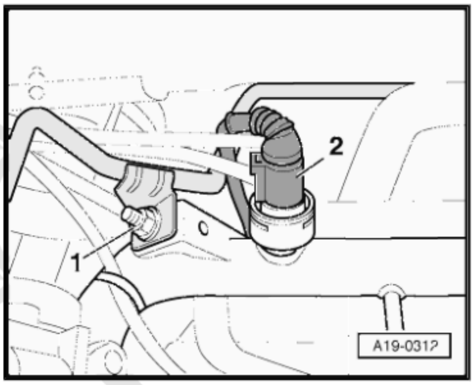
2 - Vacuum hose



Fitting location of coolant temperature sender -G62-

- At rear of coolant pipe (right-side).

2 - Coolant temperature sender -G62-

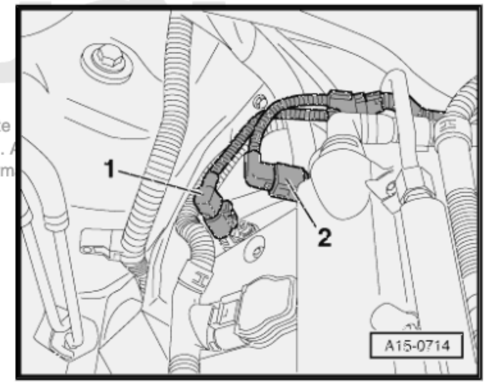


Fitting location of Hall sender -G40- and Hall sender 3 -G300-

- At rear of cylinder head (right-side).

1 - Hall sender 3 -G300-

2 - Hall sender -G40-

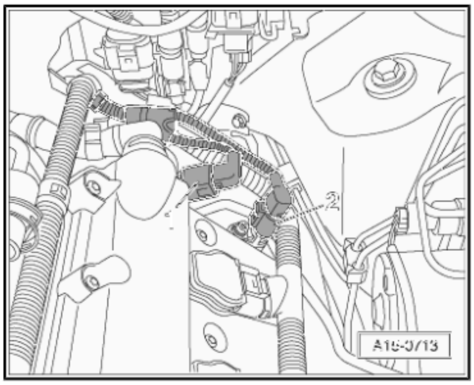


Fitting location of Hall sender 2 -G163- and Hall sender 4 -G301-

- At rear of cylinder head (left-side).

1 - Hall sender 2 -G163-

2 - Hall sender 4 -G301-



1.5 Dismantling and assembling air cleaner

1 - Water drain hose

2 - Air cleaner housing (lower section)

3 - Filter element

4 - Air duct

5 - Air cleaner housing (upper section)

6 - O-ring

- ☐ Renew

7 - Air mass meter -G70-

8 - Spring clip

9 - Air intake hose

10 - 5-pin electrical connector

11 - Cross-head screw

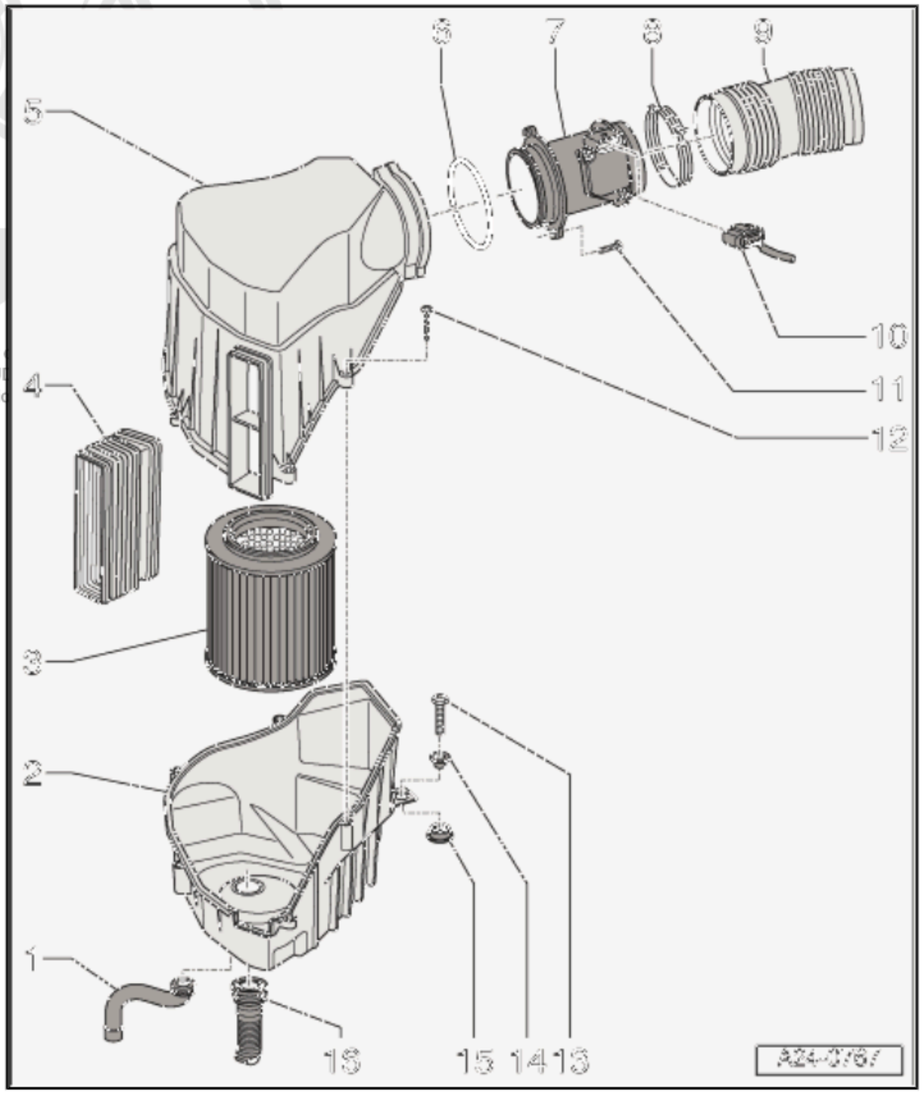
12 - Cross-head screw

13 - 5 Nm

14 - Spacer sleeve

15 - Rubber grommet

16 - Air hose to secondary air pump motor -V101-



1.6 Intake manifold change-over - exploded view of components

1 - Intake manifold change-over valve -N156-

2 - Y piece

3 - 7 Nm

4 - Vacuum unit with change-over barrel

5 - O-ring

  - ☐ Renew if damaged

6 - Securing plate

7 - Rubber grommet

8 - Spacer sleeve

9 - 10 Nm

10 - Secondary air inlet valve -N112-

11 - Non-return valve

  - ☐ Installation position: blue end faces Y piece

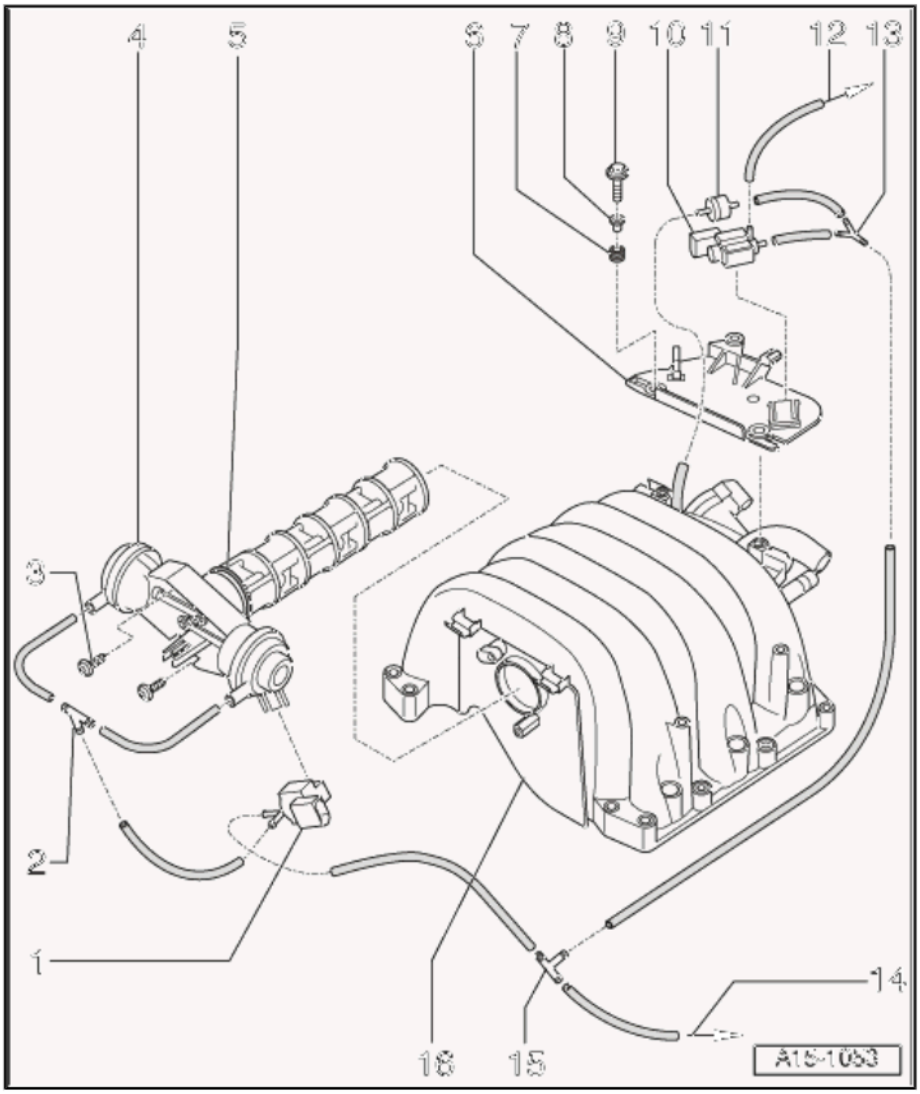
12 - To combination valves for secondary air inlet

13 - Y piece

14 - To vacuum reservoir

15 - T piece

16 - Intake manifold

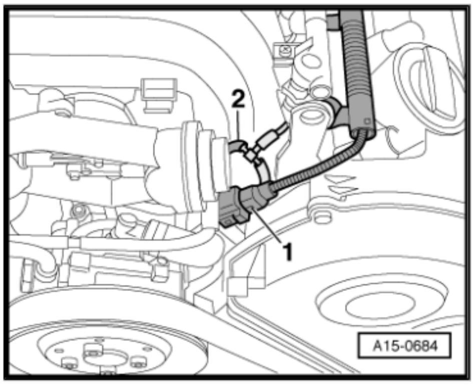


1.7 Removing and installing change-over barrel for intake manifold change-over

1.7.1 Removing

- – Move lock carrier into its service position ⇒ General body repairs, exterior; Rep. Gr. 50 .
- – Remove poly V-belt ⇒ 6-cylinder engine, mechanics; Rep. Gr. 13 .
- – Remove vane pump for power assisted steering ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48 .

- Detach electrical connector -1-.
- Detach vacuum hose -2- from T piece.
- Unscrew bolts and remove vacuum unit with change-over barrel from intake manifold.



1.7.2 Installing

Installation is carried out in the reverse order; note the following:

- Install vane pump for power assisted steering ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. Gr. 48 .
- Install poly V-belt ⇒ 6-cylinder engine, mechanics; Rep. Gr. 13 .
- Install lock carrier ⇒ General body repairs, exterior; Rep. Gr. 50 .

1.7.3 Tightening torque

Component	Nm
Vacuum unit with change-over barrel to intake manifold	7

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1.8 Intake manifold - exploded view of components

1 - Intake manifold
  - ❑ Removing and installing

2 - Resonator

3 - 10 Nm

4 - O-rings

5 - Fuel return pipe

6 - Fuel supply pipe
  - ❑ Tighten union nut to 25 Nm.

7 - Bush

8 - 10 Nm

9 - Retaining plate for solenoid valve

10 - Fuel rail

11 - Air duct

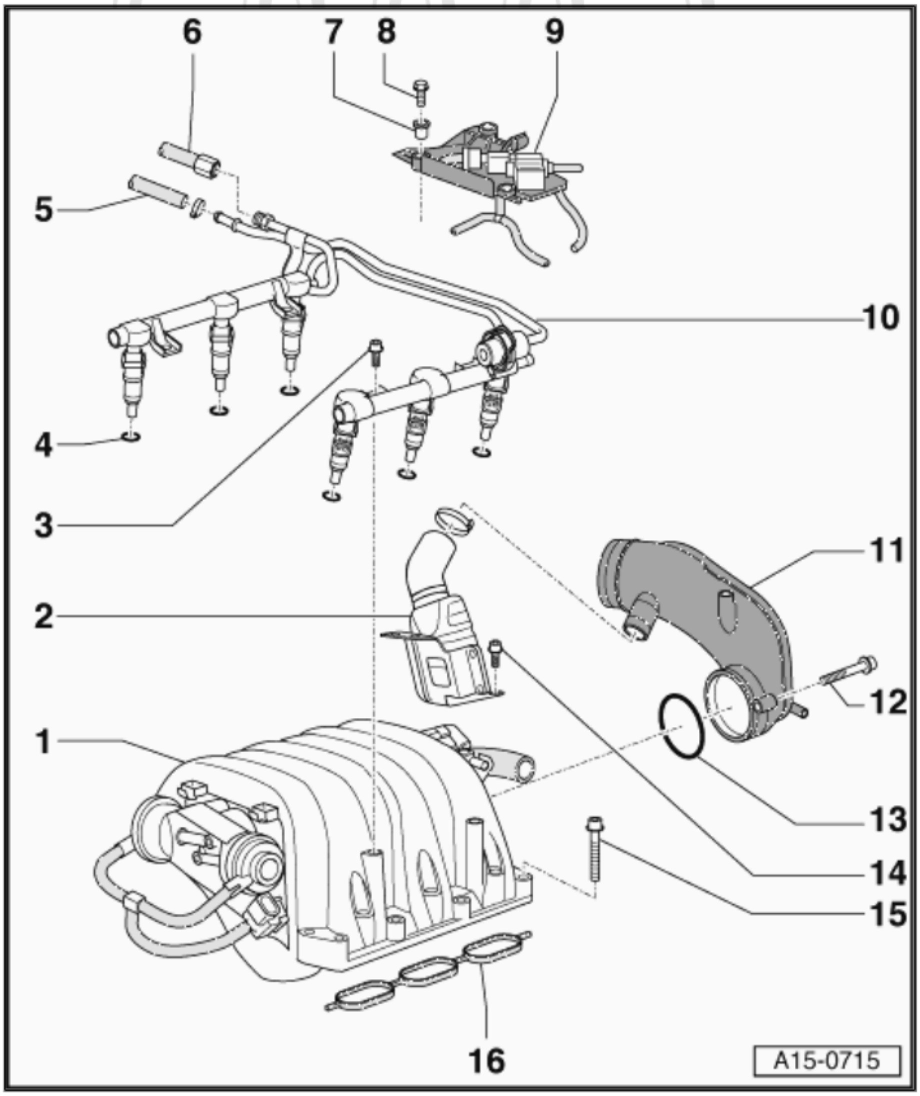
12 - 10 Nm

13 - O-ring
  - ❑ Renew

14 - 10 Nm

15 - 10 Nm
  - ❑ Tighten in stages and in diagonal sequence

16 - Intake manifold gasket
  - ❑ Renew



1.9 Removing and installing intake manifold

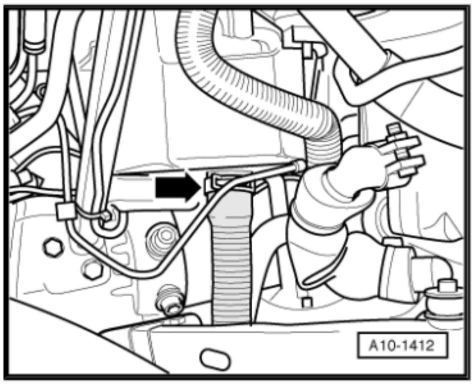
1.9.1 Removing

Note!

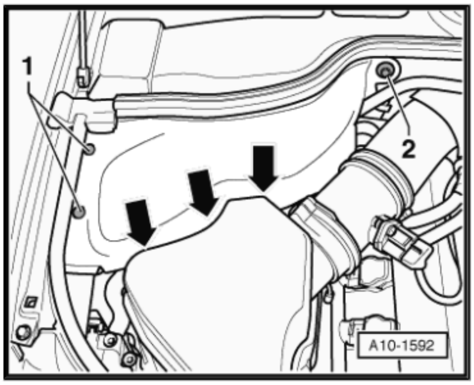
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

– Drain off coolant ⇒ 6-cylinder engine, mechanics; Rep. Gr. 19 .

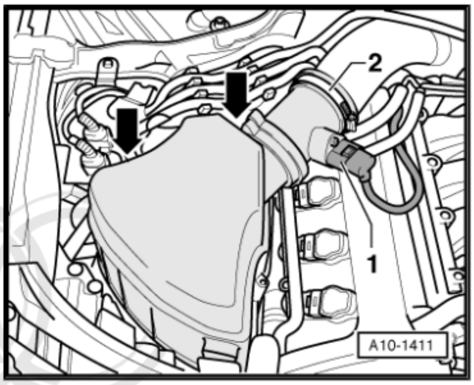
- Detach hose -arrow- to secondary air pump at bottom of air cleaner housing.



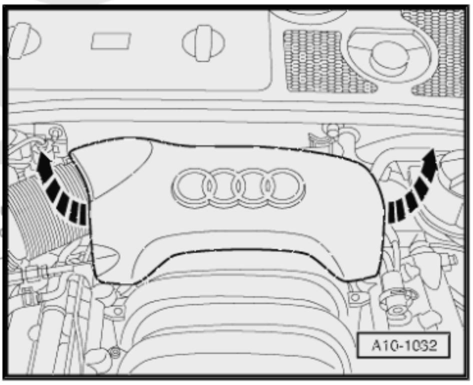
- Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew nut -2-.
- Pull cover out of retainers -arrows-.



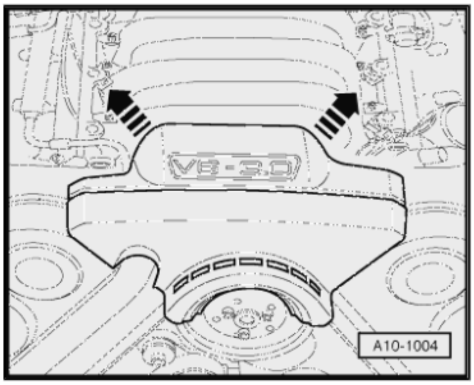
- Detach electrical connector -1-.
- Detach air intake hose -2- at air cleaner housing.
- Unscrew bolts -arrows- and remove air cleaner housing.



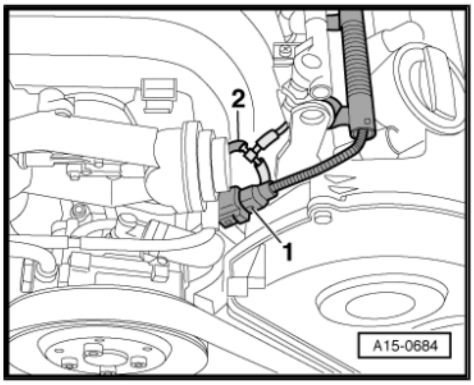
- Pull off rear engine cover -arrows- ...



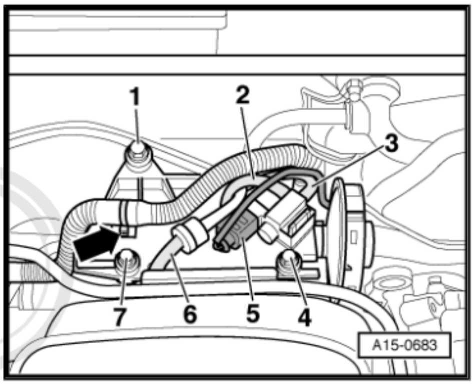
- ... as well as front engine cover -arrows-.



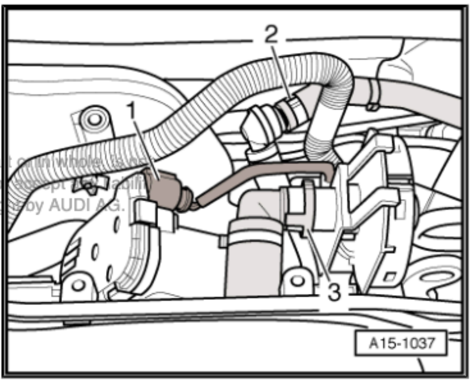
- Detach electrical connector -1-.
- Detach vacuum hose -2- from T piece.



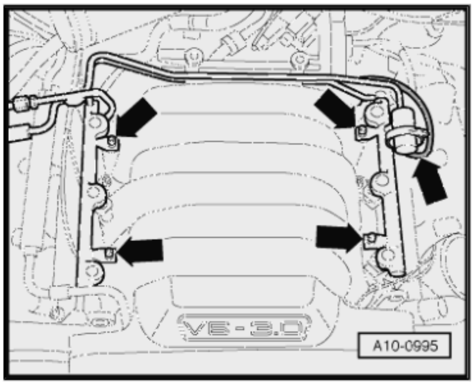
- Detach vacuum hoses -2- and -3- at intake manifold change-over valve -N156- .
- Detach vacuum hose -6- from non-return valve.
- Detach electrical connector -5-.
- Move the crankcase breather hose -arrow- clear.
- Unscrew and remove bolts -1-, -4- and -7- on retaining plate for solenoid valves.
- Detach retaining plate for solenoid valves from intake manifold.
- On underside of retaining plate, pull vacuum hose off T piece.



- Detach electrical connector -1- at throttle valve module -J338- .
- Disconnect vacuum hoses -2- and -3-.



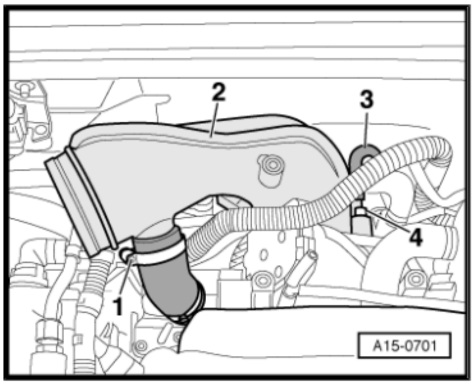
- Unplug electrical connectors at all injectors.
- Detach vacuum hose at fuel pressure regulator and unscrew securing bolts on fuel rail -arrows-.
- Pull fuel rail together with injectors off intake manifold (pull off evenly from the top) and place it on a clean cloth in the engine compartment.



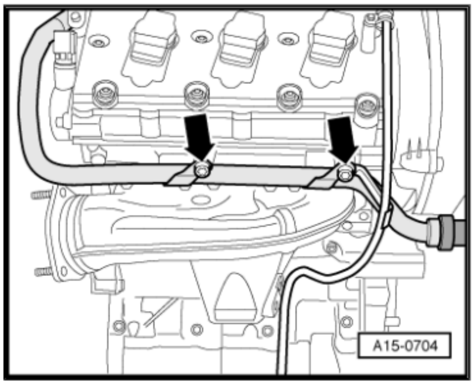
Note!

Make sure the removed injectors do not become soiled.

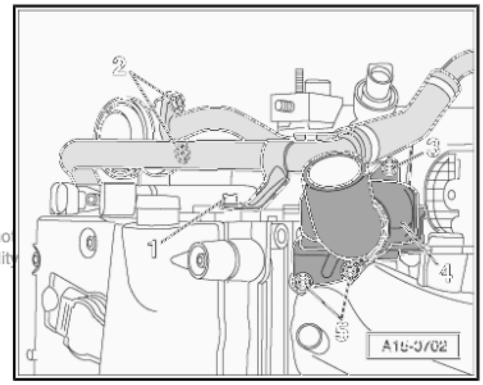
- Pull hose -1- off air duct.
- Unscrew bolt -4- and pull air duct -2- off throttle valve module -J338- .
- If fitted, pull vacuum hose -3- off at lower part of air duct.



- On right side of engine, unscrew and remove bolts -arrows- at secondary air pipe.

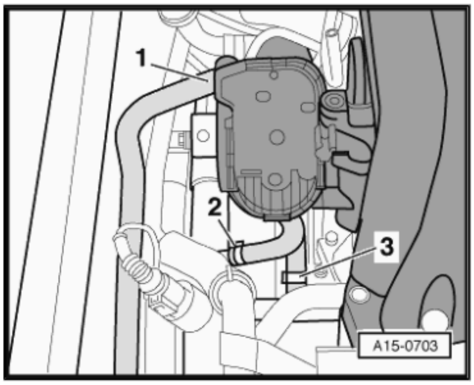


- Unscrew bolts -1- and -2- at secondary air pipes.
- Unscrew bolts -3- and -5- and remove resonator -4-.

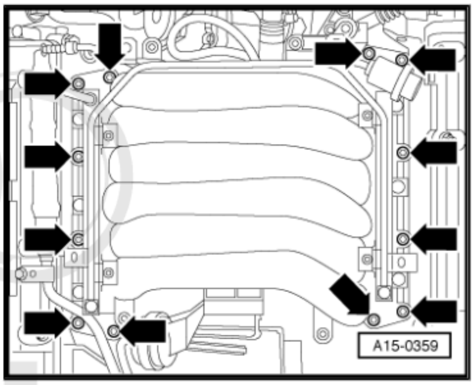


– Detach vacuum hose -1- leading to solenoid valve 1 for activated charcoal filter system -N80- .

– Detach coolant hoses -2- and -3-.



– Unscrew and remove intake manifold -arrows-.



Note!

Seal intake ports on cylinder heads with clean cloths.

1.9.2 Installing

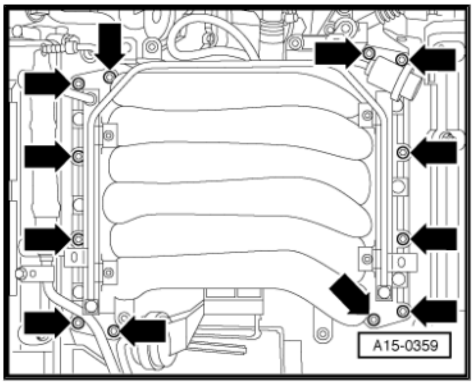
Installation is carried out in the reverse order; note the following:

Note!

- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*
- *Always renew seals and gaskets.*
- *Adhere to the instructions for installing the fuel rail ⇒ page 29 .*

– Tighten bolts on intake manifold in stages and in diagonal sequence -arrows-.

– Fill up coolant ⇒ 6-cylinder engine, mechanics; Rep. Gr. 19 .



1.9.3 Tightening torques

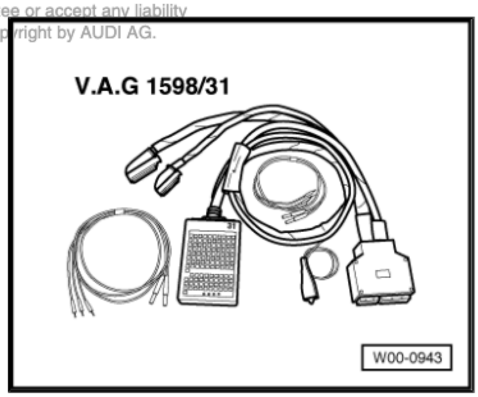
Component		Nm
Intake manifold to cylinder head		10
Resonator to coolant pipe / to cylinder head		10
Secondary air pipe	M 6	10

Component	Nm
to cylinder head M 8	23
Secondary air pipe to combination valve for secondary air	10
Air duct to intake manifold	10
Retaining plate for solenoid valves to intake manifold / air duct	10

1.10 Wiring and component check on engine control unit with test box -V.A.G 1598/31-

Special tools and workshop equipment required

- Test box -V.A.G 1598/31-



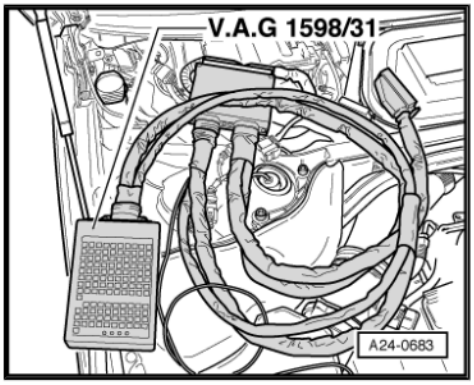
Note!

- *The test box -V.A.G 1598/31- is designed in such a way that it can be connected both to the wiring harness for the engine control unit and to the engine control unit itself at the same time.*
- *The advantage of this is that the electronic engine control system remains fully functional when the test box is connected (for example, for measuring signals when the engine is running).*
- *The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.*
- *Always use adapter set -V.A.G 1594 A- to connect test equipment (e.g. voltage tester -V.A.G 1527 B- , hand-held multimeter -V.A.G 1526 A- etc.).*

1.10.1 Procedure

– Remove engine control unit ⇒ page 21 .

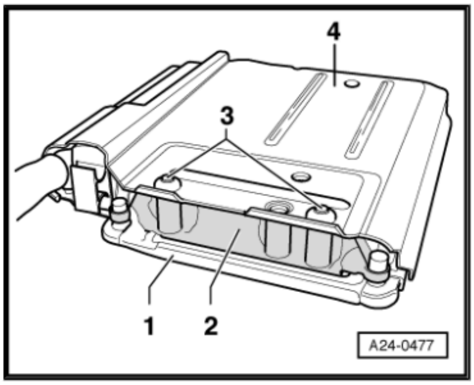
- Connect test box -V.A.G 1598/31- to wiring harness connectors.
- Connect earth clip of test box to earth.
- The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in relevant repair procedures.
- After completing test, re-install engine control unit ⇒ page 21 .



1.11 Removing and installing engine control unit

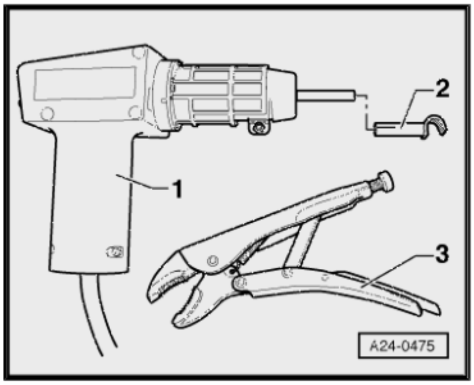
The 60-pin connector of engine control unit -1- is equipped with a protective housing -4- that is secured with a latch -2- and shear bolts -3-. To make it more difficult to unscrew the shear bolts, the threads have additionally been coated with locking fluid.

The protective housing has to be removed before the 60-pin connector can be unplugged from engine control unit (e.g. to connect test box or replace engine control unit).



Special tools and workshop equipment required

- Hot air blower from the wiring harness repair set -VAS 1978-



- Nozzle for hot air blower from the wiring harness repair set -VAS 1978-
- Vice-grip pliers (commercially available)

1.11.1 Removing

- When replacing engine control unit, select diagnosis object “Renew engine control unit” in “Guided Fault Finding”.

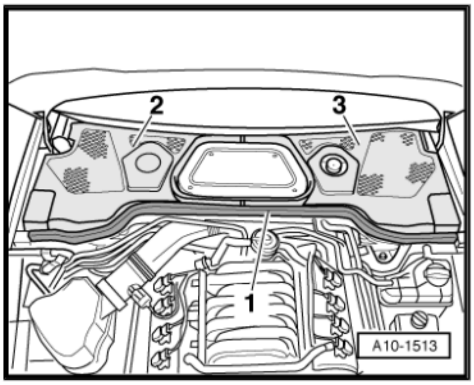
For this purpose, use vehicle diagnostic, testing and information system -5051 A- .

- Switch off ignition and remove ignition key.

– Detach plenum chamber cover (right-side) -2-.

Note!

Ignore items marked -1- and -3-.

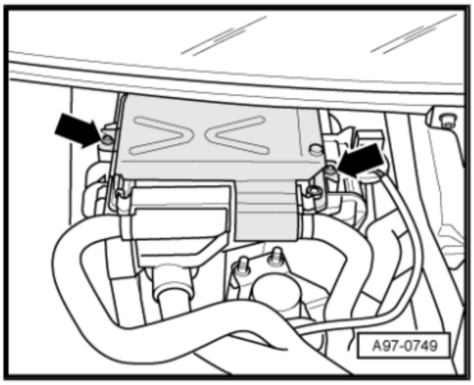


– Unscrew bolts -arrows- and pull out engine control unit towards front.

– Disconnect 81-pin connector at engine control unit.

Note!

- *The 60-pin connector is secured with the protective housing and remains attached when removing engine control unit.*
- *When the engine control unit is disconnected, the learnt values are erased but the contents of the fault memory remain intact.*



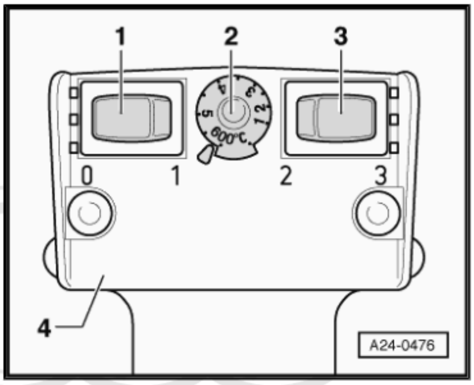
Caution

The following procedure must be followed exactly to prevent any damage (burning) to wiring, connectors, insulation and control units. Observe operating instructions for hot air blower.

– Select settings on hot-air blower as shown in illustration, i.e. set temperature potentiometer -2- to max. heat output and two-stage air flow switch -3- to position “3”.

Note!

The hot air blower will then heat thread on protective housing into which shear bolts have been screwed. This step reduces inhibiting action of locking fluid on shear bolt thread and makes it easier to unscrew these bolts.

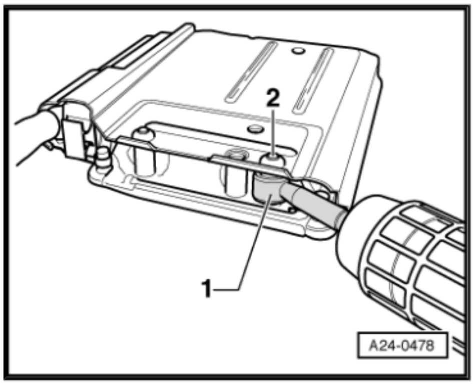


– Place the engine control unit on a heat-resistant surface (connectors remain attached).

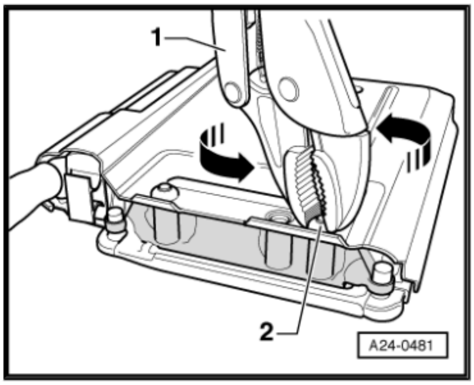
Caution

The shear bolts and protective housing also become very hot when heating the threads of the locking mechanism. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

- Direct nozzle -1- of hot air blower at bolt -2- of locking mechanism. You can rest the nozzle on the top section of the protective housing.
- Switch on the hot air blower and heat the thread for approximately 20 to 25 seconds.



- Grasp head of bolt -2- with vice-grip pliers -1- and unscrew shear bolt -arrows-.
- Repeat the procedure for the 2nd shear bolt.



Note!

Be particularly careful here, as this shear bolt is in the immediate vicinity of control unit connector.

- Release the retaining tab and detach the 60-pin connector for engine control unit.

1.11.2 Installing

Installation is carried out in the reverse order; note the following:

- Reinstall the engine control unit into the protective housing.
- Clean threaded holes for shear bolts to remove any residue from locking fluid. Cleaning can be performed using a thread tap.
- Use new shear bolts.

After installing a new engine control unit, the following operations must be performed:

- Activate engine control unit in “Guided Fault Finding” under diagnosis option “Replace engine control unit”.

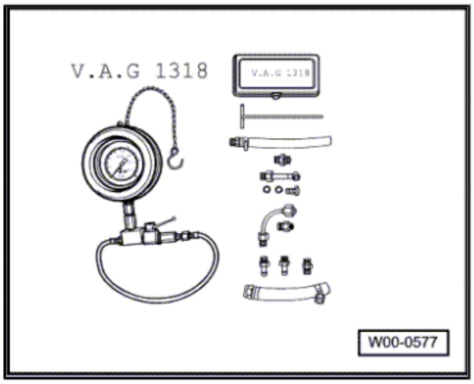
For this purpose, use vehicle diagnostic, testing and information system -VAS 5051 A- .

1.12 Checking system pressure, fuel pressure regulator and residual pressure

Fuel pressure is controlled by the fuel pressure regulator in accordance with intake pressure. As a result, the pressure drop at the injectors remains constant at every engine speed and load range.

Special tools and workshop equipment required

- K-Jetronic pressure gauge -V.A.G 1318-



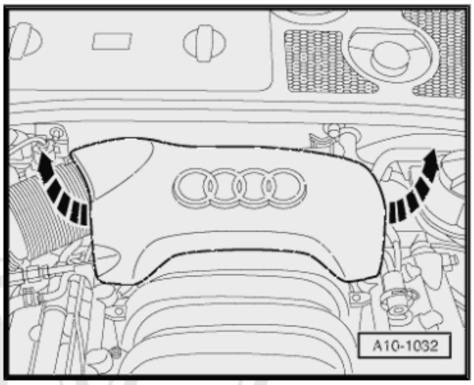
1.12.1 Test conditions

- Fuel pump relay OK.
- Fuel pump OK; checking: ⇒ Fuel supply system, petrol engines; Rep. Gr. 20 .
- Fuel filter OK
- Battery voltage at least 12.7 V
- Selector lever for automatic gearbox in position “P”.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioner switched off.

1.12.2 Checking system pressure

– Pull off rear engine cover -arrows-.

– Briefly open the fuel tank filler cap (to release pressure).



Caution

The fuel system is pressurised. Before opening the system place a clean cloth around the connection. Then dissipate pressure by carefully unfastening the connection.

– Detach fuel supply pipe.

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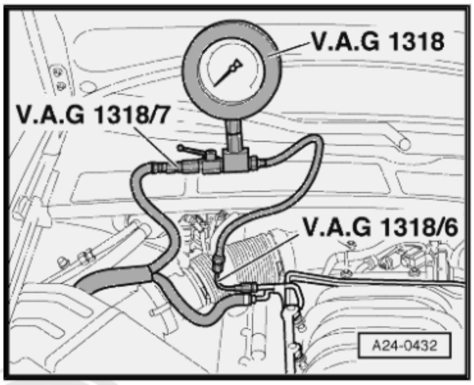
- Connect K-Jetronic pressure gauge -V.A.G 1318- with adapters -V.A.G 1318/6- and -V.A.G 1318/7- to the fuel supply pipe.



- Open cut-off valve on pressure gauge.
- Lever must point in direction of flow.

Check fuel pressure

- Disconnect vacuum hose at fuel pressure regulator and seal it.

Note!

If fuel flows out at the vacuum connection on the fuel pressure regulator during the following pressure test, the fuel pressure regulator will have to be renewed.

- Start the engine and run at idling speed.
- Measure the fuel pressure.
- Specification: 3.8 ... 4.2 bar.

If specification is not reached:

- Check the supply pipe for damage (e.g. pinching).
- Check quantity of fuel supplied by fuel pump ⇒ Fuel supply system, petrol engines; Rep. Gr. 20 .

If specification is exceeded:

- Check the return pipe for damage (e.g. pinching).

Note!

During the following test, do not allow the engine to run for too long with the vacuum hose disconnected, otherwise the increased fuel pressure will enrich the air/fuel mixture and may cause the Lambda control limits to be exceeded. This would be stored as a fault in the fault memory.

- Fit the vacuum hose onto the fuel pressure regulator and watch the pressure gauge.
- Fuel pressure should drop by approx. 0.5 bar.
- Switch off ignition.

If the pressure does not drop:

- Check vacuum hose for cracks and other damage.
- Test vacuum hose for blockages at intake manifold. To do this, disconnect hose at fuel pressure regulator and blow into it.

Checking residual pressure

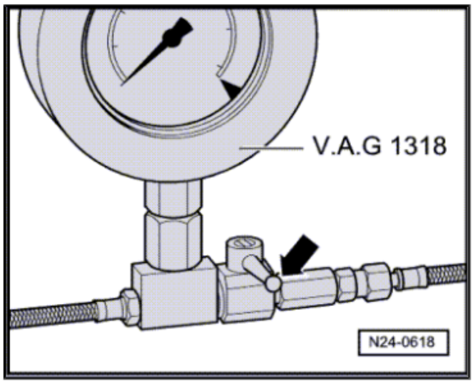
- Check leak-tightness and residual pressure by watching the drop in pressure on the pressure gauge.
- Specification after 10 minutes (engine cold): approx. 2.2 bar.
- Specification after 10 minutes (engine warm): approx. 3.0 bar.

Note!

When engine has reached operating temperature fuel expansion results in higher pressure.

If pressure drops below specification:

- Start the engine and run at idling speed.



- Allow pressure to build up, then switch off ignition. Simultaneously close the cut-off valve of the K-Jetronic pressure gauge -V.A.G 1318- (lever perpendicular to direction of flow -arrow-).
- Observe pressure drop on pressure gauge.

If the pressure now does not drop:

- Check fuel pump non-return valve

If the pressure drops again:

- Open cut-off valve on pressure gauge (lever points in direction of flow).
- Start the engine and run at idling speed.
- Allow pressure to build up, then switch off ignition. At the same time tightly clamp off the return hose.

If the pressure now does not drop:

- Renew the fuel pressure regulator.

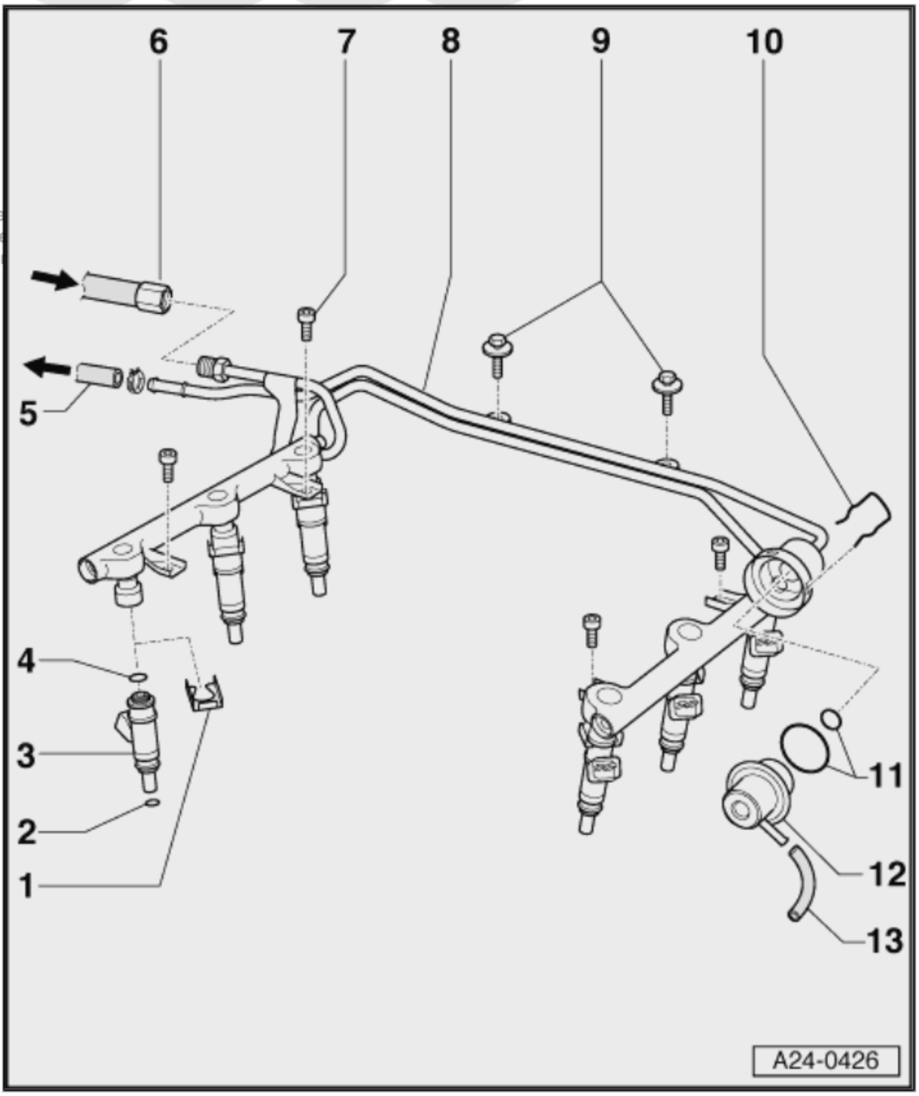
If the pressure drops again:

- Check pipe connections, O-rings on fuel rail and injectors for leaks.
- Check pressure gauge for leaks.

Note!

Before removing the pressure gauge, release the fuel pressure by opening the cut-off valve. Hold a container under the connection.

1.13 Dismantling and assembling fuel rail with injectors



1 - Retaining clip
  - ☐ Ensure it is positioned correctly on injector and fuel rail

2 - O-ring
  - ☐ Removing and installing ⇒ page 28
  - ☐ Renew
  - ☐ Lubricate with clean engine oil

3 - Fuel injector
  - ☐ Removing and installing ⇒ page 28

4 - O-ring
  - ☐ Removing and installing ⇒ page 28
  - ☐ Renew
  - ☐ Lubricate with clean engine oil

5 - Fuel return pipe

6 - Fuel supply pipe
  - ☐ Tighten union nut to 25 Nm.

7 - Hexagon socket head bolt - 10 Nm

8 - Fuel rail

9 - Bolt -10 Nm-

10 - Retaining clip
  - ☐ Check for correct fit on fuel pressure regulator

11 - O rings
  - ☐ Renew
  - ☐ Lubricate with clean engine oil

12 - Fuel pressure regulator

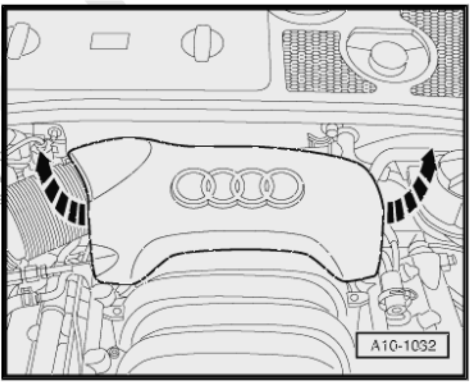
13 - Vacuum hose

Protecte
permitte
with

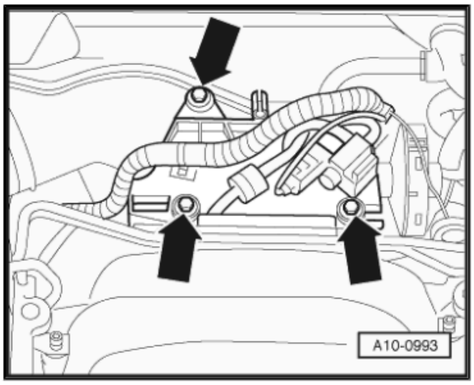
1.14 Removing and installing fuel rail and injectors

1.14.1 Removing

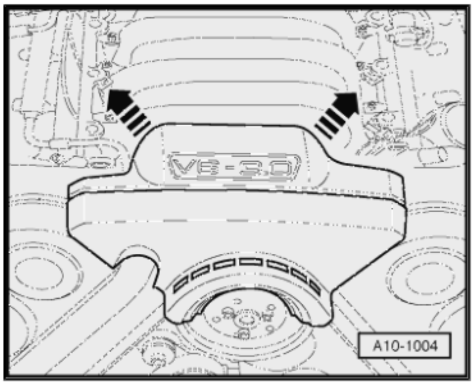
- Pull off rear engine cover -arrows-.



- Unscrew bolts for solenoid valve retaining plate -arrows-.



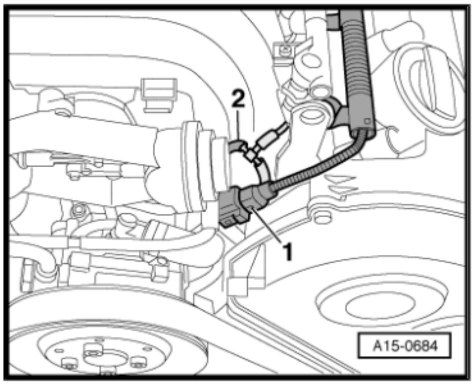
- Pull off front engine cover -arrows-.



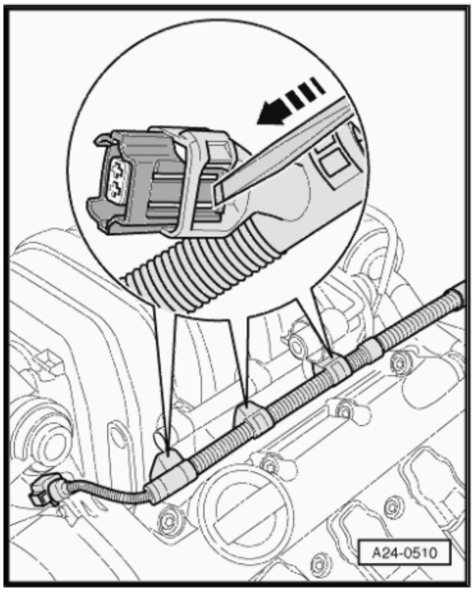
- Unplug electrical connector at intake manifold change-over valve -N156- -Item 1-.

Note!

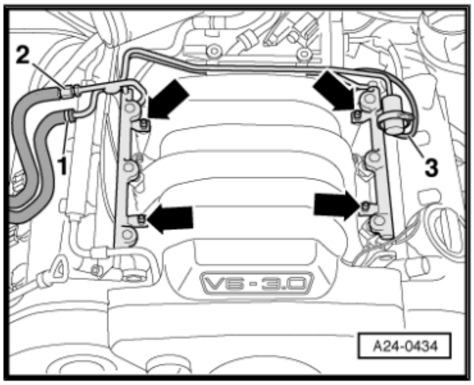
Ignore item marked -2-.



- Unplug all electrical connectors at all injectors; to do so, release connectors on underside -arrow-.



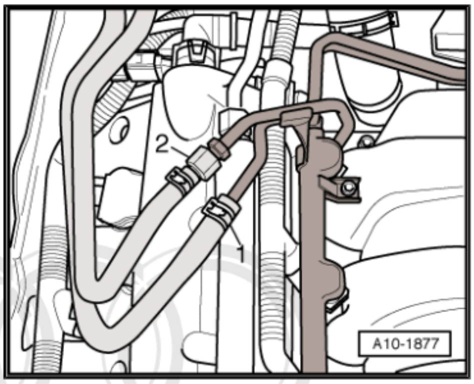
- Disconnect vacuum hose -3- from fuel pressure regulator.



Note!

To renew fuel rail you must disconnect fuel supply pipe -2- and fuel return pipe -1-.

> Caution
>
> *The fuel system is pressurised. Before opening the system place a cloth around the connection. Then dissipate pressure by carefully unfastening the connection.*



- Disconnect fuel return pipe -1- and fuel supply pipe -2- from fuel rail.
- Pull fuel rail together with injectors off intake manifold evenly and set it aside on a clean cloth in rear of engine compartment.
- To take off the injectors first pull off the retaining clips.

1.14.2 Installing

Installation is carried out in the reverse order; note the following:

- Renew the O-rings at all opened connections. (When renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Lubricate the O-rings with clean engine oil.
- Make sure injectors are installed in correct position.
- Make sure retaining clips are properly connected.

- Position fuel rail with secured injectors on intake manifold and press evenly into place.

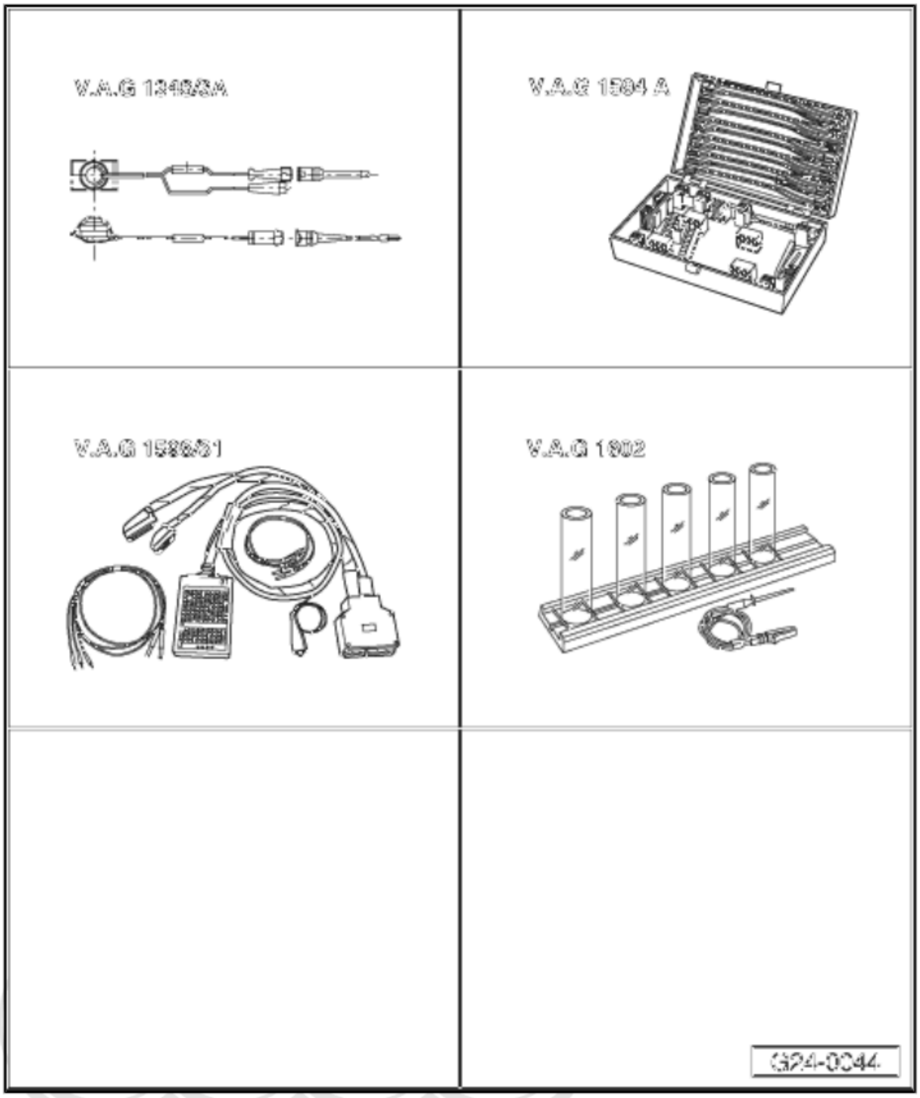
1.14.3 Tightening torque

Component	Nm
Fuel rail to intake manifold	10

1.15 Checking injection quantity and spray pattern of injectors; checking for leaks

Special tools and workshop equipment required

- ◆ Remote control -V.A.G 1348/3 A- with adapter cable -V.A.G 1348/3-2-
- ◆ Adapter set -V.A.G 1594 A-
- ◆ Injection rate tester -V.A.G 1602-
- ◆ Test box -V.A.G 1598/31-



1.15.1 Test condition

- Fuel pressure OK; testing ⇒ page 23 .

1.15.2 Preparation for test

- – Remove fuel rail (together with injectors) from intake manifold ⇒ page 28 . Fuel hoses remain connected.
- – Connect test box -V.A.G 1598/31- to wiring harness for engine control unit ⇒ page 20 . The engine control unit is not connected.
- – Use leads from adapter set -V.A.G 1594 A- to bridge contacts 1 and 65 at test box.

1.15.3 Checking for leaks

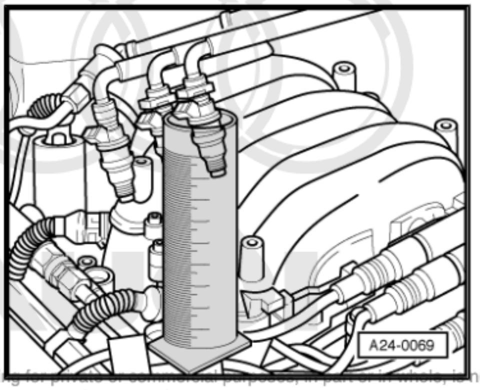
- Switch on ignition.
- The fuel pump should run.
- Visually check the fuel injectors for leaks.
- When the fuel pump is running, no more than 1 to 2 drops a minute should escape from any one of the injectors.

If the fuel loss is greater:

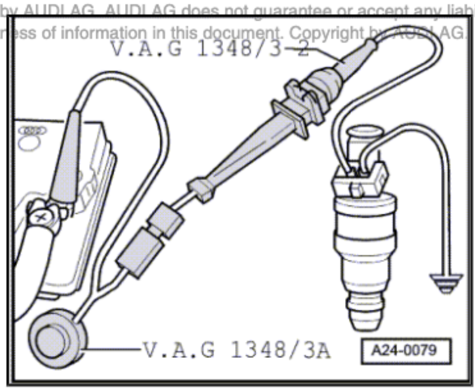
- Renew defective fuel injector ⇒ page 28 .

1.15.4 Checking injection quantity

- Place a fuel injector in a measuring glass for injection rate tester -V.A.G 1602- .



- Connect one of the contacts of fuel injector to engine earth using test lead and crocodile clamp from adapter set -V.A.G 1594 A- .
- Connect second contact of fuel injector to the remote control -V.A.G 1348/3 A- with adapter cable -V.A.G 1348/3-2- .
- Connect crocodile clamp to positive (+) battery terminal.
- Switch on ignition.
- The fuel pump should run.
- Press the remote control -V.A.G 1348/3 A- for 30 seconds.
- Carry out test for all fuel injectors using a new test glass each time.



Note!

Also check the spray pattern when testing the injection rate. The spray pattern should be the same for all injectors.

- Once all 6 injectors have been actuated, place measuring glasses on a level surface.
- Specification: 90 ... 125 ml for each injector
- Switch off fuel pump (switch off ignition).

If the measured values for one or more of the fuel injectors are outside of the specification:

- Renew defective fuel injector ⇒ page 28 .

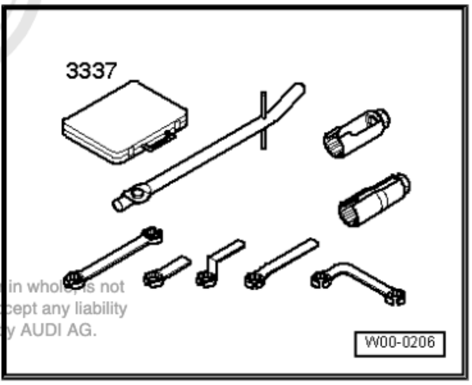
If the measured values for all the injectors are outside the specification:

- Check fuel pressure ⇒ page 23 .
- Install injectors together with fuel rail ⇒ page 29 .

1.16 Removing and installing Lambda probe before catalytic converter - bank 1 (right)

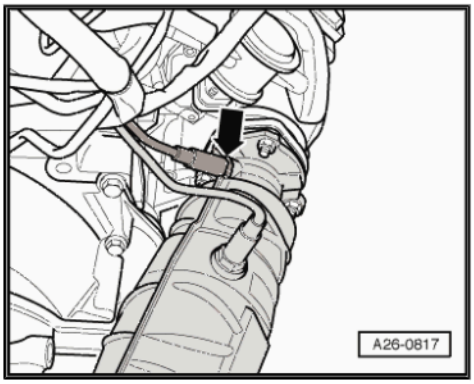
Special tools and workshop equipment required

- ◆ Lambda probe open ring spanner set -3337-



1.16.1 Removing

- – Remove front exhaust pipe (right-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .
- – Unscrew Lambda probe using socket -3337/7- .



1.16.2 Installing

Installation is carried out in the reverse order; note the following:

Note!

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ◆ *When installing, the Lambda probe wires must always be reattached at the same locations to prevent probe wires from coming into contact with exhaust pipe.*

- – Install front exhaust pipe (right-side) ⇒ 6-cylinder engine, mechanics; Rep. Gr. 26 .

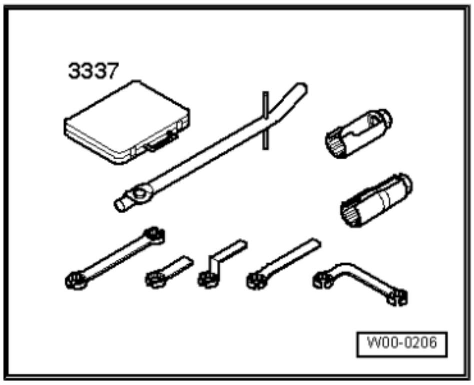
1.16.3 Tightening torque

Component	Nm
Lambda probe in front exhaust pipe	55

1.17 Removing and installing Lambda probe before catalytic converter - bank 2 (left)

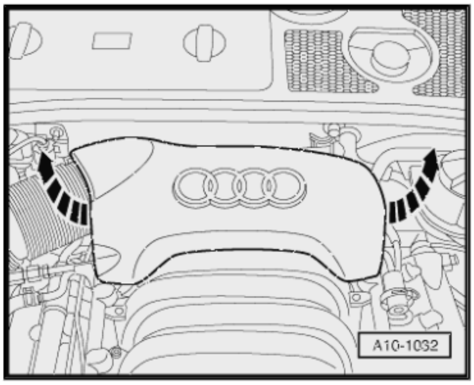
Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



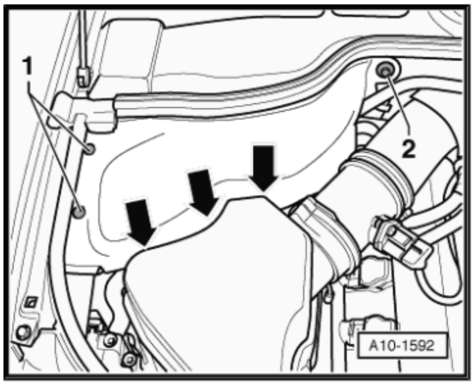
1.17.1 Removing

– Pull off rear engine cover -arrows-.



– Remove cover for right suspension turret; to do so, detach spreader clips -1- and unscrew bolted joint -2-.

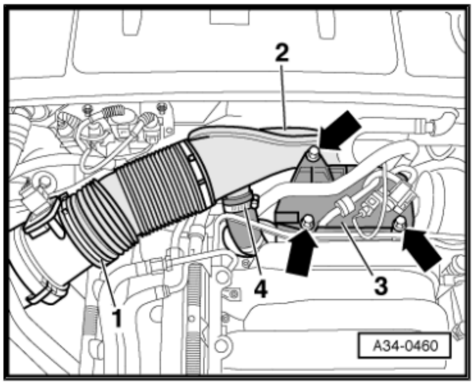
– Pull cover out of retainers -arrows-.



– Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).

– Detach air intake hose -1- at air mass meter.

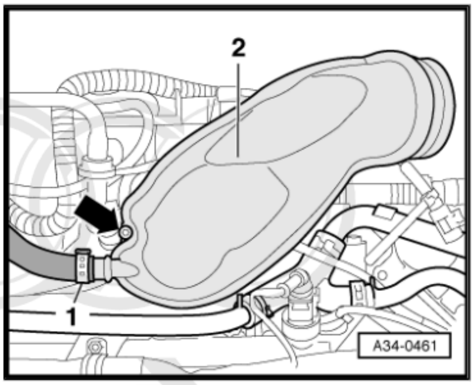
– Pull hose -4- off air duct -2-.



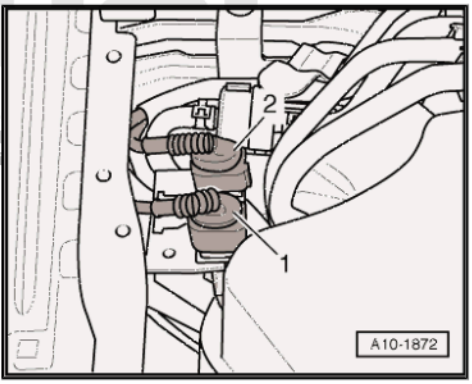
- Unscrew bolt -arrow- and disconnect air duct -2- from throttle valve module -J338- .
- If fitted, pull hose -1- off at air duct.

Note!

For illustration purposes, the air duct is shown from rear and with engine removed.



- Detach electrical connector -2- from bracket and unplug.
- Move wire clear.

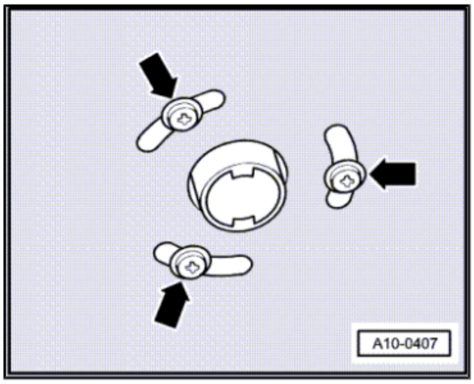


- Unbolt front left wheel.

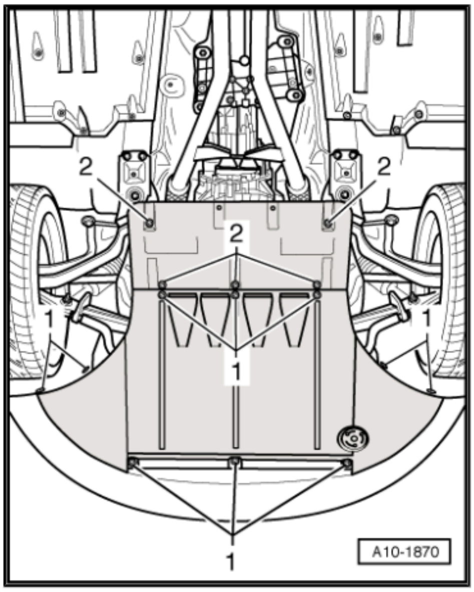
Note!

Secure brake disc with wheel bolts.

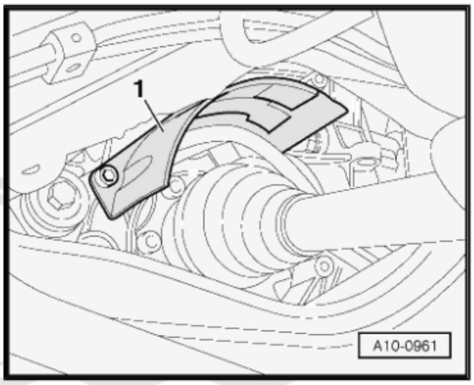
- Vehicles with auxiliary heater: remove bolts -arrows- securing exhaust pipe for auxiliary/additional heater to noise insulation.



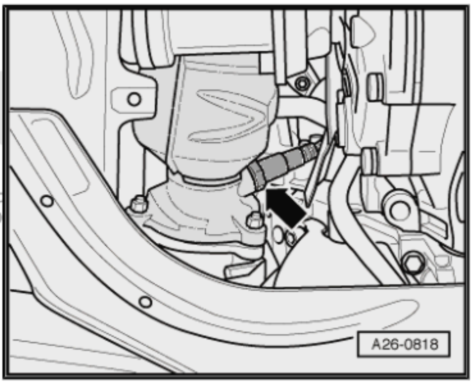
- Loosen quick release fasteners -1- and -2- and remove noise insulation parts.



- Unbolt heat shield -1- for drive shaft (left-side).



- Use ring spanner -3337/3- to unscrew Lambda probe -arrow-.



1.17.2 Installing

Installation is carried out in the reverse order; note the following:

Note!

- *Renew O-ring.*
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- *When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

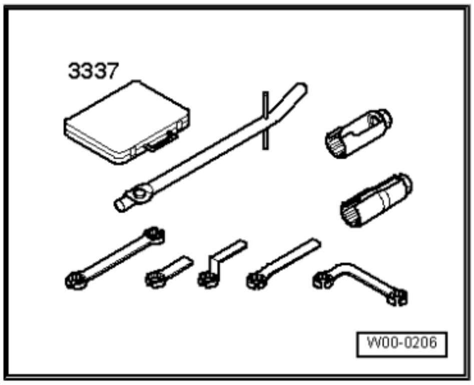
1.17.3 Tightening torques

Component		Nm
Lambda probe in front exhaust pipe		55
Drive shaft heat shield to gearbox		23
Air duct to intake manifold		10
Retaining plate to	Intake manifold	10
	Air duct	10

1.18 Removing and installing Lambda probe after catalytic converter - bank 1 (right)

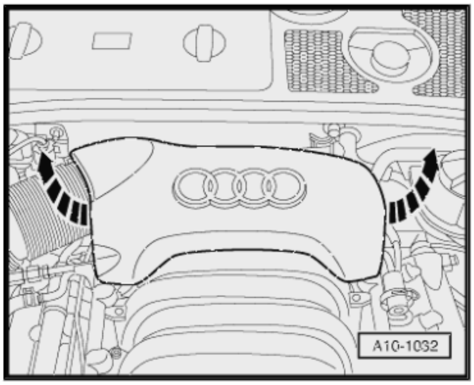
Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



1.18.1 Removing

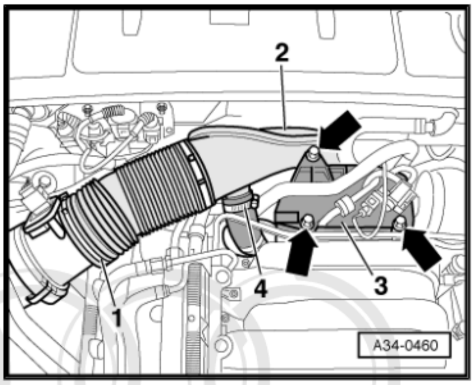
– Pull off rear engine cover -arrows-.



– Unscrew bolts for solenoid valve retaining plate -3- (-arrows-).

– Detach air intake hose -1- at air mass meter.

– Pull hose -4- off air duct -2-.

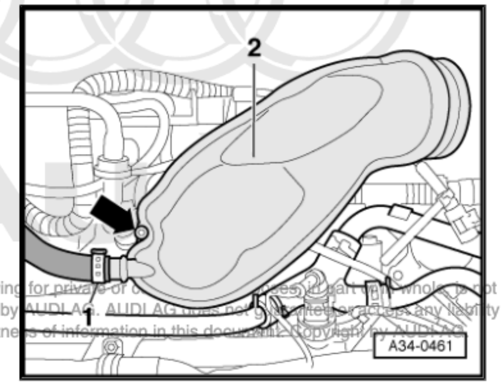


– Unscrew bolt -arrow- and disconnect air duct -2- from throttle valve module -J338- .

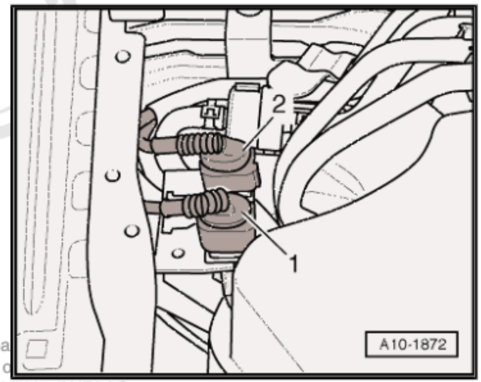
– If fitted, pull hose -1- off at air duct.

Note!

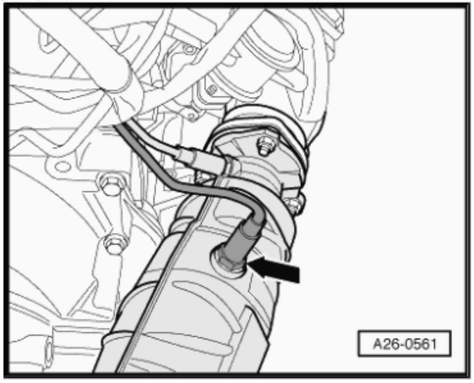
For illustration purposes, the air duct is shown from rear and with engine removed.



- Take electrical connector -1- out of retainer and unplug.
- Move wire clear.



- Unscrew Lambda probe using socket -3337/7- .



Note!

Shown from rear with engine removed for illustration purposes.

1.18.2 Installing

Installation is carried out in the reverse order; note the following:

Note!

- ♦ *Renew O-ring.*
- ♦ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ♦ *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- ♦ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

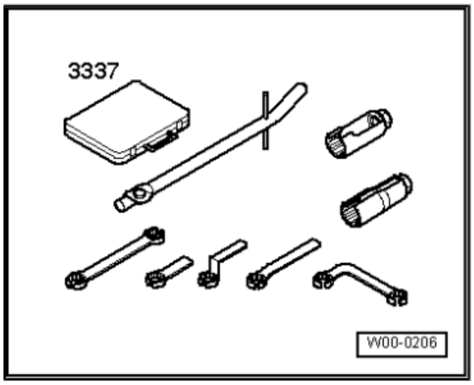
1.18.3 Tightening torques

Component		Nm
Lambda probe in front exhaust pipe		55
Air duct to intake manifold		10
Retaining plate to	Intake manifold	10
	Air duct	10

1.19 Removing and installing Lambda probe after catalytic converter - bank 2 (left)

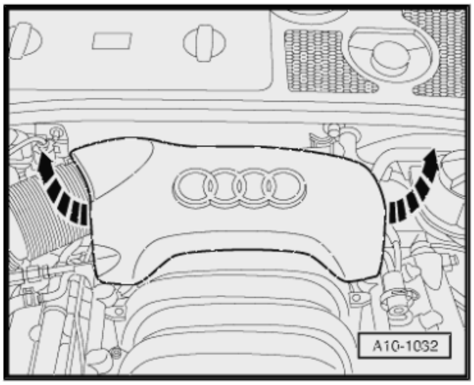
Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-



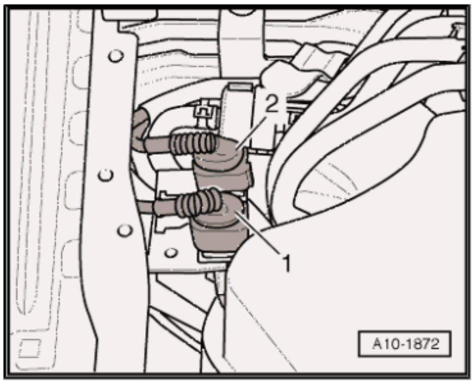
1.19.1 Removing

– Pull off rear engine cover -arrows-.

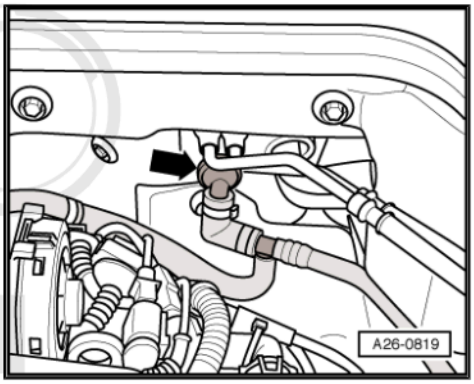


– Detach electrical connector -4- from bracket on bulkhead and unplug.

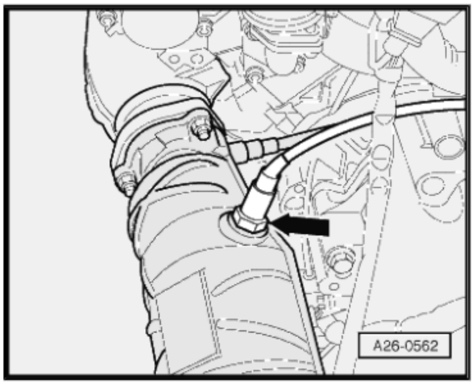
– Move wire clear.



– Detach vacuum hose -arrow- going to brake servo at bulkhead.



– Unscrew Lambda probe using socket -3337/7- .



Note!

Shown from rear with engine removed for illustration purposes.

1.19.2 Installing

Installation is carried out in the reverse order; note the following:

Note!

- *Renew O-ring.*
- *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- *If reinstalling the old Lambda probes, coat the threads with high-temperature paste ⇒ Parts catalogue . The paste must not get into the slots on the probe body.*
- *When installing, the Lambda probe wire must always be reattached at the same locations to prevent probe wire from coming into contact with exhaust pipe.*

1.19.3 Tightening torque

Component	Nm
Lambda probe in front exhaust pipe	55

28 – Ignition system

1 Checking ignition system

1.1 General notes on ignition system

- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- A voltage of at least 12.7 V is required for proper operation of electrical components.
- Certain tests may lead to a fault being detected by the control unit and stored. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- If the engine starts, runs for a short period and then cuts off after completing fault finding, repairs or component tests, this may be due to the immobiliser blocking the engine control unit. The fault memory must then be interrogated and, if necessary, the control unit must be adapted.

1.2 Safety measures

Note the following to avoid injuries or damage to the fuel injection system or ignition system:

- Do not touch or detach the ignition wires when the engine is running or when starting the engine.
- The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- If you want to crank engine at starting speed without actually starting it (for example, in order to test compression pressure), first unplug connectors from ignition coils and also from injectors.
- Certain tests may lead to a fault being detected by the control unit and stored. Therefore, interrogate and, if necessary, delete the fault memory after all repairs and tests.
- Always switch off the ignition before cleaning the engine.

1.3 Technical data

Engine code letters	ASN (3.0 ltr. / 5V /162 kW engine)	BBJ (3.0 ltr. / 5V / 160 kW engine)
Ignition timing Not adjustable (determined by control unit)		
Ignition system	Individual coil system with 6 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors	Individual coil system with 6 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs [2)]	Tightening torque 30 Nm	Tightening torque 30 Nm
Firing order	1-5-3-6-2-4	1-5-3-6-2-4

[2)] Current values ⇒ Data sheets for exhaust emission test